STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

STANDARD LOW BID PROJECT

September 19, 2006

MARINA SEWER SYSTEM UPGRADE
GREAT SALT LAKE STATE PARK

DIVISION OF PARKS AND RECREATION
SALT LAKE COUNTY, UTAH

DFCM Project Number 04147510

Nolte Associates
5217 South State Street, Suite 300
Murray, Utah 84107
(801) 743-1300

TABLE OF CONTENTS

Current copies of the following documents are hereby made part of these contract documents by reference. These documents are available on the DFCM web site at http://dfcm.utah.gov or are available upon request from DFCM.

DFCM General Conditions dated May 25, 2005.
DFCM Application and Certification for Payment dated May 25, 2005.

Technical Specifications :
Drawings:

The Agreement and General Conditions dated May 25, 2005 have been updated from versions that were formally adopted and in use prior to this date. The changes made to the General Conditions are identified in a document entitled Revisions to General Conditions that is available on DFCM's web site at http://dfcm.utah.gov

NOTICE TO CONTRACTORS

Sealed bids will be received by the Division of Facilities Construction and Management (DFCM) for:

MARINA SEWER SYSTEM UPGRADE – GREAT SALT LAKE STATE PARK
DIVISION OF PARKS & RECREATION – SALT LAKE COUNTY, UTAH
DFCM PROJECT NO: 04147510

Bids will be in accordance with the Contract Documents that will be available at 2:00 PM on Tuesday, September 19, 2006, in electronic format only on CDs from DFCM, 4110 State Office Building, Salt Lake City, Utah and on the DFCM web page at http://dfcm.utah.gov. For questions regarding this project, please contact Rick James, DFCM, at (801) 538-3270. No others are to be contacted regarding this bidding process. The construction budget for this project is $600,000.

A **mandatory** pre-bid meeting will be held at the front gate of the Saltair Facility at the Saltair Exit from I-80 at 10:00 AM on Thursday, September 28, 2006. All bidders wishing to bid on this project are required to attend this meeting.

Bids will be received until the hour of 3:00 PM on Thursday, October 5, 2006 at DFCM, 4ll0 State Office Building, Salt Lake City, Utah 84114. Bids will be opened and read aloud in the DFCM Conference Room, 4110 State Office Building, Salt Lake City, Utah. NOTE: Bids must be received at 4110 State Office Building by the specified time.

Bid security, in the amount of five percent (5%) of the bid, must be submitted as stated in the Instruction to Bidders.

The Division of Facilities Construction and Management reserves the right to reject any or all bids or to waive any formality or technicality in any bid in the interest of DFCM.

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT
Marla Workman, Contract Coordinator
4110 State Office Building, Salt Lake City, Utah 84114

PROJECT DESCRIPTION AND ADDITIONAL BIDDING REQUIREMENTS

Description:
This project is the construction of a new sewer system for the Great Salt Lake State Park Marina and the Saltair Facility. The work includes new lift stations with duplex pumps, controls, a standby generator, new septic tanks, and new underground sewer lines. The new sewer lines will be installed in two methods which include 1) slip-lining new pipe into existing sewer pipe in sections of the project and 2) direct burial of new pipe in the sections of the project. The system will flow to the existing lagoons approximately five miles east of the Saltair Facility.

Additional Requirements for Bidding:
To qualify for bidding this project, the contractor must indicate experience within the last seven years a minimum of five sewer projects. The five sewer projects must include the following:

1. All five of the projects must be over $250,000.
2. A minimum of two of the five projects must have included "slip-lining", which is to say the installation of new sewer pipe by sliding it into an existing sewer pipe.
3. A minimum of two of the five projects must have included lift stations.

All contractors wishing to bid this project shall deliver to Rick James the list of projects prior to the mandatory pre-bid meeting at 10:00 AM on Thursday, September 28, 2006. Failure to provide this list of projects will disqualify the bidder. The list of five sewer projects shall include the following: project name, project description, and a contact reference. Delivery by fax at (801)538-3267 or by email at rjames@utah.gov prior to the time indicated is acceptable.

PROJECT SCHEDULE

PROJECT NAME: **MARINA SEWER SYSTEM UPGRADE – GREAT SALT LAKE STATE PARK DIVISION OF PARKS & RECREATION – SALT LAKE COUNTY, UTAH**
DFCM PROJECT #: **04147510**

Event	Day	Date	Time	Place
Bidding Documents Available	Tuesday	September 19, 2006	2:00 PM	DFCM 4110 State Office Bldg SLC, UT or DFCM web site *
Mandatory Pre-bid Site Meeting	Thursday	September 28, 2006	10:00 AM	Front gate of the Saltair Facility at the Saltair Exit from I-80
Last Day to Submit Questions	Monday	October 2, 2006	4:00 PM	Rick James DFCM 4110 State Office Bldg SLC, UT
Final Addendum Issued	Tuesday	October 3, 2006	4:00 PM	DFCM web site *
Prime Contractors Turn In Bid and Bid Bond / Bid Opening in DFCM Conference Room	Thursday	October 5, 2006	3:00 PM	DFCM 4110 State Office Bldg SLC, UT
Sub-contractor List Due	Friday	October 6, 2006	3:00 PM	DFCM 4110 State Office Bldg SLC, UT
Project Completion	Thursday	February 1, 2007		

*** DFCM's web site address is http://dfcm.utah.gov**

BID FORM

NAME OF BIDDER _____ DATE _____

To the Division of Facilities Construction and Management
4110 State Office Building
Salt Lake City, Utah 84114

The undersigned, responsive to the "Notice to Contractors" and in accordance with the "Instructions to Bidders", in compliance with your invitation for bids for the **MARINA SEWER SYSTEM UPGRADE – GREAT SALT LAKE STATE PARK – DIVISION OF PARKS & RECREATION SALT LAKE COUNTY, UTAH – DFCM PROJECT NO. 04147510** and having examined the Contract Documents and the site of the proposed Work and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of labor, hereby proposes to furnish all labor, materials and supplies as required for the Work in accordance with the Contract Documents as specified and within the time set forth and at the price stated below. This price is to cover all expenses incurred in performing the Work required under the Contract Documents of which this bid is a part:

I/We acknowledge receipt of the following Addenda: _____

For all work shown on the Drawings and described in the Specifications and Contract Documents, I/we agree to perform for the sum of:

_____ DOLLARS ($_____)
(In case of discrepancy, written amount shall govern)

I/We guarantee that the Work will be Substantially Complete by **February 1, 2007,** should I/we be the successful bidder, and agree to pay liquidated damages in the amount of **$200.00** per day for each day after expiration of the Contract Time as stated in Article 3 of the Contractor's Agreement.

This bid shall be good for 45 days after bid opening.

Enclosed is a 5% bid bond, as required, in the sum of _____

The undersigned Contractor's License Number for Utah is _____

Upon receipt of notice of award of this bid, the undersigned agrees to execute the contract within ten (10) days, unless a shorter time is specified in the Contract Documents, and deliver acceptable Performance and Payment bonds in the prescribed form in the amount of 100% of the Contract Sum for faithful performance of the contract.

The Bid Bond attached, in the amount not less than five percent (5%) of the above bid sum, shall become the property of the Division of Facilities Construction and Management as liquidated damages for delay and additional expense caused thereby in the event that the contract is not executed and/or acceptable l00% Performance and Payment bonds are not delivered within the time set forth.

Type of Organization:

_____
(Corporation, Partnership, Individual, etc.)

Any request and information related to Utah Preference Laws:

_____

Respectfully submitted,

_____
Name of Bidder

ADDRESS:

_____

_____

_____
Authorized Signature

INSTRUCTIONS TO BIDDERS

1. Drawings and Specifications, Other Contract Documents

Drawings and Specifications, as well as other available Contract Documents, may be obtained as stated in the Invitation to Bid.

2. Bids

Before submitting a bid, each contractor shall carefully examine the Contract Documents, shall visit the site of the Work; shall fully inform themselves as to all existing conditions and limitations; and shall include in the bid the cost of all items required by the Contract Documents. If the bidder observes that portions of the Contract Documents are at variance with applicable laws, building codes, rules, regulations or contain obvious erroneous or uncoordinated information, the bidder shall promptly notify the DFCM Representative and the necessary changes shall be accomplished by Addendum.

The bid, bearing original signatures, must be typed or handwritten in ink on the Bid Form provided in the procurement documents and submitted in a sealed envelope at the location specified by the Invitation to Bid prior to the deadline for submission of bids.

Bid bond security, in the amount of five percent (5%) of the bid, made payable to the Division of Facilities Construction and Management, shall accompany bid. THE BID BOND MUST BE ON THE BID BOND FORM PROVIDED IN THE PROCUREMENT DOCUMENTS IN ORDER TO BE CONSIDERED AN ACCEPTABLE BID.

If the bid bond security is submitted on a bid bond form other than DFCM's required bid bond form, and the bid security meets all other legal requirements, the bidder will be allowed to provide an acceptable bid bond by the close of business on the next business day following notification by DFCM of submission of a defective bid bond security. NOTE: A cashier's check cannot be used as a substitute for a bid bond.

3. Contract and Bond

The Contractor's Agreement will be in the form bound in the specifications. The Contract Time will be as indicated in the bid. The successful bidder, simultaneously with the execution of the Contract Agreement, will be required to furnish a performance bond and a payment bond, both bearing original signatures, upon the forms provided in the procurement documents. The performance and payment bonds shall be for an amount equal to one hundred percent (100%) of the contract sum and secured from a company that meets the requirements specified in the requisite forms. Any bonding requirements for subcontractors will be specified in the Supplementary General Conditions.

4. Listing of Subcontractors

Listing of Subcontractors shall be as summarized in the "Instructions and Subcontractor's List Form", which are included as part of these Contract Documents. The Subcontractors List shall be delivered to DFCM or faxed to DFCM at (801)538-3677 within 24 hours of the bid opening. Requirements for listing additional subcontractors will be listed in the Contract Documents.

DFCM retains the right to audit or take other steps necessary to confirm compliance with requirements for the listing and changing of subcontractors. Any contractor who is found to not be in compliance with these requirements is subject to a debarment hearing and may be debarred from consideration for award of contracts for a period of up to three years.

5. Interpretation of Drawings and Specifications

If any person or entity contemplating submitting a bid is in doubt as to the meaning of any part of the drawings, specifications or other Contract Documents, such person shall submit to the DFCM Project Manager a request for an interpretation thereof. The person or entity submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed documents will be made only by addenda posted on DFCM's web site at http://dfcm.utah.gov. Neither the DFCM nor A/E will be responsible for any other explanations or interpretations of the proposed documents. A/E shall be deemed to refer to the architect or engineer hired by DFCM as the A/E or Consultant for the Project.

6. Addenda

Addenda will be posted on DFCM's web site at http://dfcm.utah.gov. Contractors are responsible for obtaining information contained in each addendum from the web site. Addenda issued prior to the submittal deadline shall become part of the bidding process and must be acknowledged on the bid form. Failure to acknowledge addenda may result in disqualification from bidding.

7. Award of Contract

The Contract will be awarded as soon as possible to the lowest, responsive and responsible bidder, based on the lowest combination of base bid and acceptable prioritized alternates, provided the bid is reasonable, is in the interests of the State of Utah to accept and after applying the Utah Preference Laws in U.C.A. Title 63, Chapter 56. DFCM reserves the right to waive any technicalities or formalities in any bid or in the bidding. Alternates will be accepted on a prioritized basis with Alternate 1 being highest priority, Alternate 2 having second priority, etc.

8. DFCM Contractor Performance Rating

As a contractor completes each DFCM project, DFCM, the architect/engineer and the using agency will evaluate project performance based on the enclosed "DFCM Contractor Performance Rating" form. The ratings issued on this project will not affect this project but may affect the award on future projects.

9. Licensure

The Contractor shall comply with and require all of its subcontractors to comply with the license laws as required by the State of Utah.

10. Right to Reject Bids

DFCM reserves the right to reject any or all Bids.

11. Time is of the Essence

Time is of the essence in regard to all the requirements of the Contract Documents.

12. Withdrawal of Bids

Bids may be withdrawn on written request received from bidder prior to the time fixed for opening. Negligence on the part of the bidder in preparing the bid confers no right for the withdrawal of the bid after it has been opened.

13. Product Approvals

Where reference is made to one or more proprietary products in the Contract Documents, but restrictive descriptive materials of one or more manufacturer(s) is referred to in the Contract Documents, the products of other manufacturers will be accepted, provided they equal or exceed the standards set forth in the drawings and specifications and are compatible with the intent and purpose of the design, subject to the written approval of the A/E. Such written approval must occur prior to the deadline established for the last scheduled addenda to be issued. The A/E's written approval will be in an issued addendum. If the descriptive material is not restrictive, the products of other manufacturers specified will be accepted without prior approval provided they are compatible with the intent and purpose of the design as determined by the A/E.

14. Financial Responsibility of Contractors, Subcontractors and Sub-subcontractors

Contractors shall respond promptly to any inquiry in writing by DFCM to any concern of financial responsibility of the contractor, subcontractor or sub-subcontractor.

15. Debarment

By submitting a bid, the Contractor certifies that neither it nor its principals, including project and site managers, have been, or are under consideration for, debarment or suspension, or any action that would exclude such from participation in a construction contract by any governmental department or agency. If the Contractor cannot certify this statement, attach to the bid a detailed written explanation which must be reviewed and approved by DFCM as part of the requirements for award of the Project.

BID BOND

(Title 63, Chapter 56, U. C. A. l953, as Amended)

KNOW ALL PERSONS BY THESE PRESENTS:

That _____ hereinafter referred to as the "Principal," and _____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ and authorized to transact business in this State and U. S. Department of the Treasury Listed, (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the STATE OF UTAH, hereinafter referred to as the "Obligee," in the amount of $_____ (5% of the accompanying bid), being the sum of this Bond to which payment the Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that whereas the Principal has submitted to Obligee the accompanying bid incorporated by reference herein, dated as shown, to enter into a contract in writing for the _____ _____ Project.

NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION IS SUCH, that if the said principal does not execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the principal, then the sum of the amount stated above will be forfeited to the State of Utah as liquidated damages and not as a penalty; if the said principal shall execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the Principal, then this obligation shall be null and void. It is expressly understood and agreed that the liability of the Surety for any and all defaults of the Principal hereunder shall be the full penal sum of this Bond. The Surety, for value received, hereby stipulates and agrees that obligations of the Surety under this Bond shall be for a term of sixty (60) days from actual date of the bid opening.

PROVIDED, HOWEVER, that this Bond is executed pursuant to provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the above bounden parties have executed this instrument under their several seals on the date indicated below, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

DATED this _____ day of _____, 20_____ .

Principal's name and address (if other than a corporation):

_____

_____

By: _____

Title: _____

Principal's name and address (if a corporation):

_____

_____

By: _____

Title: _____

(Affix Corporate Seal)

Surety's name and address:

_____

_____

STATE OF _____)
) ss.
COUNTY OF _____)

By: _____
Attorney-in-Fact (Affix Corporate Seal)

On this ____ day of _____, 20____, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20_____.
My Commission Expires: _____
Resides at: _____

_____
NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

INSTRUCTIONS AND SUBCONTRACTORS LIST FORM

The three low bidders, as well as all other bidders that desire to be considered, are required by law to submit to DFCM within 24 hours of bid opening a list of **ALL** first-tier subcontractors, including the subcontractor's name, bid amount and other information required by Building Board Rule and as stated in these Contract Documents, on the following basis:

PROJECTS UNDER $500,000 - ALL SUBS $20,000 OR OVER MUST BE LISTED
PROJECTS $500,000 OR MORE - ALL SUBS $35,000 OR OVER MUST BE LISTED

- Any additional subcontractors identified in the bid documents shall also be listed.
- The DFCM Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law.
- List subcontractors for base bid as well as the impact on the list that the selection of any alternate may have.
- Bidder may not list more than one subcontractor to perform the same work.
- Bidder must list "Self" if performing work itself.

LICENSURE:

The subcontractor's name, the type of work, the subcontractor's bid amount, and the subcontractor's license number as issued by DOPL, if such license is required under Utah Law, shall be listed. Bidder shall certify that all subcontractors, required to be licensed, are licensed as required by State law. A subcontractor includes a trade contractor or specialty contractor and does not include suppliers who provide only materials, equipment, or supplies to a contractor or subcontractor.

BIDDER LISTING 'SELF' AS PERFORMING THE WORK:

Any bidder that is properly licensed for the particular work and intends to perform that work itself in lieu of a subcontractor that would otherwise be required to be on the subcontractor list, must insert the term 'Self' for that category on the subcontractor list form. Any listing of 'Self' on the sublist form shall also include the amount allocated for that work.

'SPECIAL EXCEPTION':

A bidder may list 'Special Exception' in place of a subcontractor when the bidder intends to obtain a subcontractor to perform the work at a later date because the bidder was unable to obtain a qualified or reasonable bid under the provisions of U.C.A.Section 63A-5-208(4). The bidder shall insert the term 'Special Exception' for that category of work, and shall provide documentation with the subcontractor list describing the bidder's efforts to obtain a bid of a qualified subcontractor at a reasonable cost and why the bidder was unable to obtain a qualified subcontractor bid. The Director must find that the bidder complied in good faith with State law requirements for any 'Special Exception' designation, in order for the bid to be considered. If awarded the contract, the Director shall supervise the bidder's efforts to obtain a qualified subcontractor bid. The amount of the awarded contract may not be adjusted to reflect the actual amount of the subcontractor's bid. Any listing of 'Special Exception' on the sublist form shall also include amount allocated for that work.

GROUNDS FOR DISQUALIFICATION:

The Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law. Director may withhold awarding the contract to a particular bidder if one or more of the proposed subcontractors are considered by the Director to be unqualified to do the Work or for such other reason in the best interest of the State of Utah. Notwithstanding any other provision in these instructions, if there is a good faith error on the sublist form, at the sole discretion of the Director, the Director may provide notice to the contractor and the contractor shall have 24 hours to submit the correction to the Director. If such correction is submitted timely, then the sublist requirements shall be considered met.

CHANGES OF SUBCONTRACTORS SPECIFICALLY IDENTIFIED ON SUBLIST FORM:

Subsequent to twenty-four hours after the bid opening, the contractor may change its listed subcontractors only after receiving written permission from the Director based on complying with all of the following criteria.

(1) The contractor has established in writing that the change is in the best interest of the State and that the contractor establishes an appropriate reason for the change, which may include, but not is not limited to, the following reasons: the original subcontractor has failed to perform, or is not qualified or capable of performing, and/or the subcontractor has requested in writing to be released.
(2) The circumstances related to the request for the change do not indicate any bad faith in the original listing of the subcontractors.
(3) Any requirement set forth by the Director to ensure that the process used to select a new subcontractor does not give rise to bid shopping.
(4) Any increase in the cost of the subject subcontractor work is borne by the contractor.
(5) Any decrease in the cost of the subject subcontractor work shall result in a deductive change order being issued for the contract for such decreased amount.
(6) The Director will give substantial weight to whether the subcontractor has consented in writing to being removed unless the Contractor establishes that the subcontractor is not qualified for the work.

EXAMPLE:

Example of a list where there are only four subcontractors:

TYPE OF WORK	SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"	SUBCONTRACTOR BID AMOUNT	CONT. LICENSE #
ELECTRICAL	ABCD Electric Inc.	$350,000.00	123456789000
LANDSCAPING	"Self"	300,000.00	123456789000
CONCRETE (ALTERNATE #1)	XYZ Concrete Inc	298,000.00	987654321000
MECHANICAL	"Special Exception" (attach documentation)	Fixed at: 350,000.00	(TO BE PROVIDED AFTER OBTAINING SUBCONTRACTOR)

PURSUANT TO STATE LAW - SUBCONTRACTOR BID AMOUNTS CONTAINED IN THIS SUBCONTRACTOR LIST SHALL NOT BE DISCLOSED UNTIL THE CONTRACT HAS BEEN AWARDED.

SUBCONTRACTORS LIST

FAX TO 801-538-3677

PROJECT TITLE: _____

Caution: You must read and comply fully with instructions.

TYPE OF WORK	SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"	SUBCONTRACTOR BID AMOUNT	CONT. LICENSE #

We certify that:

1. This list includes all subcontractors as required by the instructions, including those related to the base bid as well as any alternates.
2. We have listed "Self" or "Special Exception" in accordance with the instructions.
3. All subcontractors are appropriately licensed as required by State law.

FIRM: _____

DATE: _____ SIGNED BY: _____

NOTICE: FAILURE TO SUBMIT THIS FORM, PROPERLY COMPLETED AND SIGNED, AS REQUIRED IN THESE CONTRACT DOCUMENTS, SHALL BE GROUNDS FOR DFCMS REFUSAL TO ENTER INTO A WRITTEN CONTRACT WITH BIDDER. ACTION MAY BE TAKEN AGAINST BIDDERS BID BOND AS DEEMED APPROPRIATE BY DFCM. ATTACH A SECOND PAGE IF NECESSARY.

FUGITIVE DUST PLAN

The Contractor will fill out the form and file the original with the Division of Air Quality and a copy of the form with the Division of Facilities Construction & Management, prior to the issuance of any notice to proceed.

The Contractor will be fully responsible for compliance with the Fugitive Dust Control Plan, including the adequacy of the plan, any damages, fines, liability, and penalty or other action that results from noncompliance.

Utah Division of Air Quality
April 20, 1999

GUIDANCE THAT MUST BE CONSIDERED IN DEVELOPING AND SUBMITTING A DUST CONTROL PLAN FOR COMPLIANCE WITH R307-309-3, 4, 5, 6, 7

Source Information:

1. Name of your operation (source): provide a name if the source is a construction site.

2. Address or location of your operation or construction site.

3. UTM coordinates or Longitude/Latitude of stationary emission points at your operation.

4. Lengths of the project, if temporary (time period).

5. Description of process (include all sources of dust and fugitive dust). Please, if necessary, use additional sheets of paper for this description. Be sure to mark it as an attachment.

6. Type of material processed or disturbed.

7. Amount of material processed (tons per year, tons per month, lbs./hr., and applicable units).

8. Destination of product (where will the material produced be used or transported, be specific, provide address or specific location), information needed for temporary relocation applicants.

9. Identify the individual who is responsible for the implementation and maintenance of fugitive dust control measures. List name(s), position(s) and telephone number(s).

10. List, and attach copies of any contract lease, liability agreement with other companies that may, or will, be responsible for dust control on site or on the project.

Description of Fugitive Dust Emission Activities
(Things to consider in addressing fugitive dust control strategies.)

1. Type of activities (drilling and blasting, road construction, development construction, earth moving and excavation, handling and hauling materials, cleaning and leveling, etc).

2. List type of equipment generating the fugitive dust.

3. Diagram the location of each activity or piece of equipment on site. Please attach the diagram.

4. Provide pictures or drawings of each activity. Include a drawing of the unpaved/paved road network used to move loads "on" and "off" property.

5. Vehicle miles travels on unpaved roads associated with the activity (average speed).

6. Type of dust emitted at each source (coal, cement, sand, soil, clay, dust, etc.)

7. Estimate the size of the release area at which the activity occurs (square miles). For haul or dirt roads include total miles of road in use during the activity.

Description of Fugitive Dust Emission Controls on Site

Control strategies must be designed to meet 20% opacity or less on site (a lesser opacity may be defined by Approval Order conditions or federal requirements such as NSPS), and control strategies must prevent exceeding 10% opacity from fugitive dust at the property boundary (site boundary) for compliance with R307-309-3.

1. Types of ongoing emission controls proposed for each activity, each piece of equipment, and haul roads.

2. Types of additional dust controls proposed for bare, exposed surfaces (chemical stabilization, synthetic cover, wind breaks, vegetative cover, etc).

3. Method of application of dust suppressant.

4. Frequency of application of dust suppressant.

5. Explain what triggers the use of a special control measure other than routine measures already in place, such as covered loads or measures covered by a permit condition (increase in opacity, high winds, citizen complaints, dry conditions, etc).

6. Explain in detail what control strategies/measures will be implemented off-hours, i.e., Saturdays/Sundays/Holidays, as well as 6 PM to 6 AM each day.

Description of Fugitive Dust Control Off-site

Prevent, to the maximum extent possible, deposition of materials, which may create fugitive dust on public and private paved roads in compliance with R307-309-5, 6, 7.

1. Types of emission controls initiated by your operation that are in place "off" property (application of water, covered loads, sweeping roads, vehicle cleaning, etc.).

2. Proposed remedial controls that will be initiated promptly if materials, which may create fugitive dust, are deposited on public and private paved roads.

Submit the Dust Control Plan to:

Executive Secretary
Utah Air Quality Board
POB 144820
15 North 1950 West
Salt Lake City, Utah 84114-4820

Phone: (801) 536-4000
FAX: (801) 536-4099

Fugitive Dust Control Plan Violation Report

When a source is found in violation of R307-309-3 or in violation of the Fugitive Dust Control Plan, the course must submit a report to the Executive Secretary within 15 days after receiving a Notice of Violation. The report must include the following information:

1. Name and address of dust source.

2. Time and duration of dust episode.

3. Meteorological conditions during the dust episode.

4. Total number and type of fugitive dust activities and dust producing equipment within each operation boundary. If no change has occurred from the existing dust control plan, the source should state that the activity/equipment is the same.

5. Fugitive dust activities or dust producing equipment that caused a violation of R-307-309-3 or the sources dust control plan.

6. Reasons for failing to control dust from the dust generating activity or equipment.

7. New and/or additional fugitive dust control strategies necessary to achieve compliance with R307-309-3, 4, 5, 6, or 7.

8. If it can not be demonstrated that the current approved Dust Control Plan can result in compliance with R307-309-3 through 7, the Dust Control Plan must be revised so as to demonstrate compliance with 307-309-3 through 7. Within 30 days of receiving a fugitive dust Notice of Violation, the source must submit the revised Plan to the Executive Secretary for review and approval.

Submit the Dust Control Plan to:

Executive Secretary
Utah Air Quality Board
POB 144820
15 North 1950 West
Salt Lake City, Utah 84114-4820

Phone: (801) 536-4000
FAX: (801) 536-4099

Attachments: DFCM Form FDR R-307-309, Rule 307-309

CONTRACTOR'S AGREEMENT

FOR:

_____
_____
_____

THIS CONTRACTOR'S AGREEMENT, made and entered into this ____ day of _____, 20__, by and between the DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT, hereinafter referred to as "DFCM", and _____, incorporated in the State of _____ and authorized to do business in the State of Utah, hereinafter referred to as "Contractor", whose address is _____.

WITNESSETH: WHEREAS, DFCM intends to have Work performed at _____ _____.

WHEREAS, Contractor agrees to perform the Work for the sum stated herein.

NOW, THEREFORE, DFCM and Contractor for the consideration provided in this Contractor's Agreement, agree as follows:

ARTICLE 1. SCOPE OF WORK. The Work to be performed shall be in accordance with the Contract Documents prepared by _____ and entitled "_____."

The DFCM General Conditions ("General Conditions") dated May 25, 2005 on file at the office of DFCM and available on the DFCM website, are hereby incorporated by reference as part of this Agreement and are included in the specifications for this Project. All terms used in this Contractor's Agreement shall be as defined in the Contract Documents, and in particular, the General Conditions.

The Contractor Agrees to furnish labor, materials and equipment to complete the Work as required in the Contract Documents which are hereby incorporated by reference. It is understood and agreed by the parties hereto that all Work shall be performed as required in the Contract Documents and shall be subject to inspection and approval of DFCM or its authorized representative. The relationship of the Contractor to the DFCM hereunder is that of an independent Contractor.

ARTICLE 2. CONTRACT SUM. The DFCM agrees to pay and the Contractor agrees to accept in full performance of this Contractor's Agreement, the sum of _____ _____ DOLLARS AND NO CENTS ($_____.00), which is the base bid, and which sum also includes the cost of a 100% Performance Bond and a 100%

Payment Bond as well as all insurance requirements of the Contractor. Said bonds have already been posted by the Contractor pursuant to State law. The required proof of insurance certificates have been delivered to DFCM in accordance with the General Conditions before the execution of this Contractor's Agreement.

ARTICLE 3. TIME OF COMPLETION AND DELAY REMEDY. The Work shall be Substantially Complete within _____ (___) calendar days after the date of the Notice to Proceed. Contractor agrees to pay liquidated damages in the amount of $_____ per day for each day after expiration of the Contract Time until the Contractor achieves Substantial Completion in accordance with the Contract Documents, if Contractor's delay makes the damages applicable. The provision for liquidated damages is: (a) to compensate the DFCM for delay only; (b) is provided for herein because actual damages can not be readily ascertained at the time of execution of this Contractor's Agreement; (c) is not a penalty; and (d) shall not prevent the DFCM from maintaining Claims for other non-delay damages, such as costs to complete or remedy defective Work.

No action shall be maintained by the Contractor, including its or Subcontractor or suppliers at any tier, against the DFCM or State of Utah for damages or other claims due to losses attributable to hindrances or delays from any cause whatsoever, including acts and omissions of the DFCM or its officers, employees or agents, except as expressly provided in the General Conditions. The Contractor may receive a written extension of time, signed by the DFCM, in which to complete the Work under this Contractor's Agreement in accordance with the General Conditions.

ARTICLE 4. CONTRACT DOCUMENTS. The Contract Documents consist of this Contractor's Agreement, the Conditions of the Contract (DFCM General Conditions, Supplementary and other Conditions), the Drawings, Specifications, Addenda and Modifications. The Contract Documents shall also include the bidding documents, including the Invitation to Bid, Instructions to Bidders/ Proposers and the Bid/Proposal, to the extent not in conflict therewith and other documents and oral presentations that are documented as an attachment to the contract.

All such documents are hereby incorporated by reference herein. Any reference in this Contractor's Agreement to certain provisions of the Contract Documents shall in no way be construed as to lessen the importance or applicability of any other provisions of the Contract Documents.

ARTICLE 5. PAYMENT. The DFCM agrees to pay the Contractor from time to time as the Work progresses, but not more than once each month after the date of Notice to Proceed, and only upon Certificate of the A/E for Work performed during the preceding calendar month, ninety-five percent (95%) of the value of the labor performed and ninety-five percent (95%) of the value of materials furnished in place or on the site. The Contractor agrees to furnish to the DFCM invoices for materials purchased and on the site but not installed, for which the Contractor requests payment and agrees to

safeguard and protect such equipment or materials and is responsible for safekeeping thereof and if such be stolen, lost or destroyed, to replace same.

Such evidence of labor performed and materials furnished as the DFCM may reasonably require shall be supplied by the Contractor at the time of request for Certificate of Payment on account. Materials for which payment has been made cannot be removed from the job site without DFCM's written approval. Five percent (5%) of the earned amount shall be retained from each monthly payment. The retainage, including any additional retainage imposed and the release of any retainage, shall be in accordance with UCA 13-8-5 as amended. Contractor shall also comply with the requirements of UCA 13-8-5, including restrictions of retainage regarding subcontractors and the distribution of interest earned on the retention proceeds. The DFCM shall not be responsible for enforcing the Contractor's obligations under State law in fulfilling the retention law requirements with subcontractors at any tier.

ARTICLE 6. INDEBTEDNESS. Before final payment is made, the Contractor must submit evidence satisfactory to the DFCM that all payrolls, materials bills, subcontracts at any tier and outstanding indebtedness in connection with the Work have been properly paid. Final Payment will be made after receipt of said evidence, final acceptance of the Work by the DFCM as well as compliance with the applicable provisions of the General Conditions.

Contractor shall respond immediately to any inquiry in writing by DFCM as to any concern of financial responsibility and DFCM reserves the right to request any waivers, releases or bonds from Contractor in regard to any rights of Subcontractors (including suppliers) at any tier or any third parties prior to any payment by DFCM to Contractor.

ARTICLE 7. ADDITIONAL WORK. It is understood and agreed by the parties hereto that no money will be paid to the Contractor for additional labor or materials furnished unless a new contract in writing or a Modification hereof in accordance with the General Conditions and the Contract Documents for such additional labor or materials has been executed. The DFCM specifically reserves the right to modify or amend this Contractor's Agreement and the total sum due hereunder either by enlarging or restricting the scope of the Work.

ARTICLE 8. INSPECTIONS. The Work shall be inspected for acceptance in accordance with the General Conditions.

ARTICLE 9. DISPUTES. Any dispute, PRE or Claim between the parties shall be subject to the provisions of Article 7 of the General Conditions. DFCM reserves all rights to pursue its rights and remedies as provided in the General Conditions.

ARTICLE 10. TERMINATION, SUSPENSION OR ABANDONMENT. This Contractor's Agreement may be terminated, suspended or abandoned in accordance with the General Conditions.

ARTICLE 11. DFCM'S RIGHT TO WITHHOLD CERTAIN AMOUNT AND MAKE USE THEREOF. The DFCM may withhold from payment to the Contractor such amount as, in DFCM's judgment, may be necessary to pay just claims against the Contractor or Subcontractor at any tier for labor and services rendered and materials furnished in and about the Work. The DFCM may apply such withheld amounts for the payment of such claims in DFCM's discretion. In so doing, the DFCM shall be deemed the agent of Contractor and payment so made by the DFCM shall be considered as payment made under this Contractor's Agreement by the DFCM to the Contractor. DFCM shall not be liable to the Contractor for any such payment made in good faith. Such withholdings and payments may be made without prior approval of the Contractor and may be also be prior to any determination as a result of any dispute, PRE, Claim or litigation.

ARTICLE 12. INDEMNIFICATION. The Contractor shall comply with the indemnification provisions of the General Conditions.

ARTICLE 13. SUCCESSORS AND ASSIGNMENT OF CONTRACT. The DFCM and Contractor, respectively bind themselves, their partners, successors, assigns and legal representatives to the other party to this Agreement, and to partners, successors, assigns and legal representatives of such other party with respect to all covenants, provisions, rights and responsibilities of this Contractor's Agreement. The Contractor shall not assign this Contractor's Agreement without the prior written consent of the DFCM, nor shall the Contractor assign any moneys due or to become due as well as any rights under this Contractor's Agreement, without prior written consent of the DFCM.

ARTICLE 14. RELATIONSHIP OF THE PARTIES. The Contractor accepts the relationship of trust and confidence established by this Contractor's Agreement and covenants with the DFCM to cooperate with the DFCM and A/E and use the Contractor's best skill, efforts and judgment in furthering the interest of the DFCM; to furnish efficient business administration and supervision; to make best efforts to furnish at all times an adequate supply of workers and materials; and to perform the Work in the best and most expeditious and economic manner consistent with the interests of the DFCM.

ARTICLE 15. AUTHORITY TO EXECUTE AND PERFORM AGREEMENT. Contractor and DFCM each represent that the execution of this Contractor's Agreement and the performance thereunder is within their respective duly authorized powers.

ARTICLE 16. ATTORNEY FEES AND COSTS. Except as otherwise provided in the dispute resolution provisions of the General Conditions, the prevailing party shall be entitled to reasonable attorney fees and costs incurred in any action in the District Court and/or appellate body to enforce this Contractor's Agreement or recover damages or any other action as a result of a breach thereof.

IN WITNESS WHEREOF, the parties hereto have executed this Contractor's Agreement on the day and year stated hereinabove.

CONTRACTOR: _____

_____
Signature Date

Title: _____

State of _____)
)
County of _____) _____
Please type/print name clearly

On this ____ day of _____, 20____, personally appeared before me, _____, whose identity is personally known to me (or proved to me on the basis of satisfactory evidence) and who by me duly sworn (or affirmed), did say that he (she) is the _____ (title or office) of the firm and that said document was signed by him (her) in behalf of said firm.

_____
Notary Public

(SEAL)

My Commission Expires _____

APPROVED AS TO AVAILABILITY OF FUNDS:

_____
David D. Williams, Jr. Date
DFCM Administrative Services Director

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT

_____
_____- Manager Date
Capital Development/Improvements

APPROVED AS TO FORM:
ATTORNEY GENERAL
May 25, 2005
By: Alan S. Bachman
Asst Attorney General

APPROVED FOR EXPENDITURE:

_____
Division of Finance Date

PERFORMANCE BOND

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

That _____ hereinafter referred to as the "Principal" and _____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ and authorized to transact business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah, hereinafter referred to as the "Obligee, " in the amount of _____ _____ DOLLARS ($_____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____, for the approximate sum of _____ _____ Dollars ($_____), which Contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall faithfully perform the Contract in accordance with the Contract Documents including, but not limited to, the Plans, Specifications and conditions thereof, the one year performance warranty, and the terms of the Contract as said Contract may be subject to Modifications or changes, then this obligation shall be void; otherwise it shall remain in full force and effect.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the state named herein or the heirs, executors, administrators or successors of the Owner.

The parties agree that the dispute provisions provided in the Contract Documents apply and shall constitute the sole dispute procedures of the parties.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the Provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20_____.

WITNESS OR ATTESTATION:

_____

PRINCIPAL:

_____

By: _____

(Seal)

Title: _____

WITNESS OR ATTESTATION:

_____

SURETY:

_____

By: _____

Attorney-in-Fact (Seal)

STATE OF _____)

) ss.

COUNTY OF _____)

On this _____ day of _____, 20____, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney in-fact of the above-named Surety Company and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20_____.

My commission expires: _____

Resides at: _____

_____

NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

DFCM FORM 1b 081506

PAYMENT BOND

(Title 63, Chapter 56, U. C. A. l953, as Amended)

KNOW ALL PERSONS BY THESE PRESENTS:

That _____ hereinafter referred to as the "Principal," and _____ _____, a corporation organized and existing under the laws of the State of _____authorized to do business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); with its principal office in the City of _____, hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah hereinafter referred to as the "Obligee," in the amount of _____ Dollars ($_____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____ for the approximate sum of _____ _____ Dollars ($_____), which contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall pay all claimants supplying labor or materials to Principal or Principal's Subcontractors in compliance with the provisions of Title 63, Chapter 56, of Utah Code Annotated, l953, as amended, and in the prosecution of the Work provided for in said Contract, then, this obligation shall be void; otherwise it shall remain in full force and effect.

That said Surety to this Bond, for value received, hereby stipulates and agrees that no changes, extensions of time, alterations or additions to the terms of the Contract or to the Work to be performed thereunder, or the specifications or drawings accompanying same shall in any way affect its obligation on this Bond, and does hereby waive notice of any such changes, extensions of time, alterations or additions to the terms of the Contract or to the Work or to the specifications or drawings and agrees that they shall become part of the Contract Documents.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20____.

WITNESS OR ATTESTATION:

_____

PRINCIPAL:

_____

By: _____

(Seal)

Title: _____

WITNESS OR ATTESTATION:

_____

SURETY:

_____

By: _____

Attorney-in-Fact (Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

On this _____ day of _____, 20____, personally appeared before me _____ _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20_____.

My commission expires: _____

Resides at: _____

_____

NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

DFCM FORM 1b 081506

CHANGE ORDER #_____

CONTRACTOR:

ARCHITECT:

AGENCY OR INSTITUTION:
PROJECT NAME:
PROJECT NUMBER:
CONTRACT NUMBER:
DATE:

CONSTRUCTION CHANGE DIRECTIVE NO.	PROPOSAL REQUEST NO.	AMOUNT		DAYS	
		INCREASE	DECREASE	INCREASE	DECREASE

	Amount	Days	Date
ORIGINAL CONTRACT			
TOTAL PREVIOUS CHANGE ORDERS			
TOTAL THIS CHANGE ORDER			
ADJUSTED CONTRACT			

DFCM and Contractor agree that the terms, contract sum, scope of the Work and time specified in this Change Order shall constitute the full accord and satisfaction, and complete adjustment to the Contract and includes all direct and indirect costs and effects related to, incidental to, and/or reasonably implied from such change in the contract terms, sum, scope of the Work and time.

Contractor:_____
Date

Architect/Engineer:_____
Date

Agency or Institution:_____
Date

DFCM: _____
Date

Funding Verification:_____
Date

CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT _____ PROJECT NO: _____
AGENCY/INSTITUTION _____

AREA ACCEPTED _____

The Work performed under the subject Contract has been reviewed on this date and found to be Substantially Completed as defined in the General Conditions; including that the construction is sufficiently completed in accordance with the Contract Documents, as modified by any change orders agreed to by the parties, so that the State of Utah can occupy the Project or specified area of the Project for the use for which it is intended.

The DFCM - (Owner) accepts the Project or specified area of the Project as Substantially Complete and will assume full possession of the Project or specified area of the Project at _____ (time) on _____ (date).

The DFCM accepts the Project for occupancy and agrees to assume full responsibility for maintenance and operation, including utilities and insurance, of the Project subject to the itemized responsibilities and/or exceptions noted below:

_____

_____

The Owner acknowledges receipt of the following closeout and transition materials:

☐ As-built Drawings ☐ O & M Manuals ☐ Warranty Documents ☐ Completion of Training Requirements

A list of items to be completed or corrected (Punch List) is attached hereto. The failure to include an item on it does not alter the responsibility of the Contractor to complete all the Work in accordance with the Contract Documents, including authorized changes thereof. The amount of _____(Twice the value of the punch list work) shall be retained to assure the completion of the punch list work.

The Contractor shall complete or correct the Work on the list of (Punch List) items appended hereto within _____ _____calendar days from the above date of issuance of this Certificate. The amount withheld pending completion of the list of items noted and agreed to shall be: $_____. If the list of items is not completed within the time allotted the Owner has the right to be compensated for the delays and/or complete the work with the help of independent contractor at the expense of the retained project funds. If the retained project funds are insufficient to cover the delay/completion damages, the Owner shall be promptly reimbursed for the balance of the funds needed to compensate the Owner.

_____	by:	_____	
CONTRACTOR (include name of firm)		(Signature)	DATE
_____	by:	_____	
A/E (include name of firm)		(Signature)	DATE
_____	by:	_____	
USING INSTITUTION OR AGENCY		(Signature)	DATE
_____	by:	_____	
DFCM (Owner)		(Signature)	DATE

4110 State Office Building, Salt Lake City, Utah 84114 cc: Parties Noted
telephone 801-538-3018 • facsimile 801-538-3267 • http://dfcm.utah.gov DFCM, Director

STATE OF UTAH

DEPARTMENT OF ADMINISTRATIVE SERVICES
DIVISION OF FACILITIES CONSTRUCTION & MANAGEMENT
DFCM Project No. 04147510

GREAT SALT LAKE MARINA AND SALTAIR WASTEWATER SYSTEM IMPROVEMENTS

TECHNICAL SPECIFICATIONS

Project Engineer

NOLTE ASSOCIATES, INC.
Consultants/Engineers
Salt Lake Office
5217 South State Street, Suite 300
Murray, Utah 84107
(801) 743-1300

August 2006

TECHNICAL SPECIFICATIONS

DIVISION 1 - GENERAL REQUIREMENTS

DIVISION 2 - SITEWORK

DIVISIONS 3 – CONCRETE

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.01 GENERAL CONDITIONS

A. The work to be performed under this project shall consist of furnishing all labor, materials, and equipment necessary or required to complete the work in all respects as shown on the plans and as herein specified. All work, materials, and services not expressly shown or called for in the Contract Documents which may be necessary to complete the construction of the work in good faith shall be performed, furnished, and installed by CONTRACTOR as though originally so specified or shown, at no increase in cost to OWNER.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. The purpose of this project is to rehabilitate the existing sanitary force main sewer system in Great Salt Lake Marina State Park (GSL Marina) and Saltair facilities. The work will involve upgrading the existing lift stations at GSL Marina site and the Maintenance building nearby and constructing one new lift station at Saltair. GSL Marina is located approximately 15 miles west of Salt Lake City along I-80 on the south shore of the Great Salt Lake in Salt Lake County. The Saltair resort is two miles east of GSL Marina.

B. The CONTRACTOR shall furnish and install the following systems and system components:

- Construct one new lift station at the Saltair facility.
- Upgrade the existing lift station at the GSL Marina Maintenance building.
- Upgrade existing lift station and wet well located in GSL Marina restroom facility.
- Rehabilitate approximately 20,900 feet (4.0 miles) of sewer force main that parallels the Frontage Road from GSL Marina to the existing lagoons by the slipling method (insertion of 6-inch diameter pipes).
- Abandon existing four lift stations along the existing pipeline from GSL Marina to the existing lagoon, including the existing Saltair Lift Station.

1.03 CONTRACT METHOD

A. This work will be constructed under a Lump Sum basis.

B. CONTRACTOR shall include the General Conditions and Supplementary Conditions of the Contract as a part of all of its subcontract agreements.

1.04 WORK SEQUENCE

A. The contract time for substantial and final completion is as indicated in the BID FORM, and is on a calendar day basis commencing from the date of the Notice to Proceed.

1.05 CONTRACTOR USE OF PROJECT SITE

A. CONTRACTOR's use of the project site shall be limited to its construction operations, including on-site storage of materials and equipment, on-site fabrication facilities, and field offices.

1.06 PROJECT SECURITY

A. CONTRACTOR shall make all necessary provisions to protect the project and CONTRACTOR's facilities from fire, theft, and vandalism, and the public from unnecessary exposure to injury.

1.07 CHANGES IN THE WORK

A. It is mutually understood that it is inherent in the nature of municipal construction that some changes in the plans and specifications may be necessary during the course of construction to adjust them to field conditions, and that it is of the essence of the CONTRACT to recognize a normal and expected margin of change. The ENGINEER shall have the right to make such changes, from time to time, in the plans, in the character if the work, and in the scope of the project as may be necessary or desirable to ensure the completion of the work in the most satisfactory manner without invalidating the CONTRACT.

- END OF SECTION -

SECTION 01040

COORDINATION

PART 1 GENERAL

1.01 COORDINATION

A. The OWNER and/or utility owners may be working within the project area while this contract is in progress. If so, the CONTRACTOR shall schedule his work in conjunction with other entities to minimize mutual interference.

B. The CONTRACTOR shall coordinate with the ENGINEER and the OWNER with respect to progress, all quality control issues and testing.

C. CONTRACTOR shall notify ENGINEER and the Owner's Representative of the schedule for materials testing required by CONTRACTOR in Section 01440 a minimum of 24 hours in advance.

D. If required to work in Utah Department of Transportation (UDOT) right-of-way, CONTRACTOR shall notify UDOT 72 hours prior to work being performed therein. Work within the UDOT right-of-way shall be in accordance with their required permit and their license agreement with OWNER.

E. The CONTRACTOR's working hours shall be within the hours of 7 AM to 6 PM. Monday through Friday.

PART 2 SEQUENCE OF WORK

A. CONTRACTOR shall perform work of installing the new lift station at Saltair and sliplining the segment of pipe from Saltair to the Wastewater Total Containment Lagoons before the rehabilitation of the GSL Marina and Maintenance Building facilities, and sliplining the segment of pipe from the Lift Station 4 to Saltair.

-END OF SECTION-

SECTION 01050

FIELD ENGINEERING

PART 1 GENERAL

1.01 GENERAL

A. OWNER shall provide all survey construction staking as necessary to complete the facilities and appurtenant work according to the contract documents, including:

1. Building corner offsets.
2. Benchmark network throughout the construction zone.
3. Removal and replacement of survey monuments if required. Any removal of survey monuments, without notifying the Engineer/Surveyor, is illegal and replacement costs will be charged to the CONTRACTOR.

B. CONTRACTOR shall be responsible for notifying utility owners and requesting location staking of all utilities in the areas of construction. All utility staking shall be protected during construction activities from removal and disturbance. CONTRACTOR shall be responsible for replacement of all stakes removed as a result of CONTRACTOR and Subcontractor activities.

- END OF SECTION -

SECTION 01070

ABBREVIATIONS

PART 1 GENERAL

1.01 DESCRIPTION

A. Wherever in these Specifications references are made to the standards, specifications, or other published data of the various national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only. As a guide to the user of these specifications, the following acronyms or abbreviations which may appear in these specifications shall have the meanings indicated herein.

1.02 ABBREVIATIONS AND ACRONYMS

AAR	Association of American Railroads
AASHTO	American Association of the State Highway and Transportation Officials
ACI	American Concrete Institute
AGA	American Gas Association
AGC	American General Contractors
AI	The Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American Nation Standards Institute, Inc.
APWA	American Public Works Association
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASOC	American Society of Quality Control
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
BBC	Basic Building Code, Building Officials and Code Administrators International
CEMA	Conveyors Equipment Manufacturers' Association
CGA	Compressed Gas Association
CLFMI	Chain Link Fence Manufacturers' Institute

CMA	Concrete Masonry Association
CRSI	Concrete Reinforcing Steel Institute
DWQ	Department of Water Quality
DWR	Drinking Water Regulations
EIA	Electronic Industries Association
ETC	Electrical Test Laboratories
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IME	Institute of Makers of Explosives
ISA	Instrument Society of America
ISO	International Organization of Standardization
ITE	Institute of Traffic Engineers
MBMA	Metal Building Manufacturer's Association
NACE	National Association of Corrosion Engineers
NBS	National Bureau of Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
RWMA	Resistance Welder Manufacturer's Association
SAE	Society of Automotive Engineers
SSPWC	Standard Specification for Public Works Construction
UDOT	Utah Department of Transportation
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
UPRR	Union Pacific Railroad
WCRSI	Western Concrete Reinforcing Steel Institute
WRI	Wire Reinforcements Institute, Inc.
WWPA	Western Wood Products Association

1.03 DEFINITIONS

CONTRACTOR The person or persons performing the construction work.

OWNER Division of Facilities Construction and Management (DFCM), or other responsible parties for rehabilitation of existing wastewater system in Great Salt Lake Marina and Saltair facilities.

SEWER FORCE MAIN	Sewer pipe that is under pressure through pumping.
UPDES	Utah Pollution Discharge Elimination System
BMP	Best Management Practices
NOI	Notice of Intent
SWPPP	Storm Water Pollution Prevention Plan

- END OF SECTION -

SECTION 01090

REFERENCE STANDARDS

PART 1 GENERAL

1.01 GENERAL

A. TITLES OF SECTIONS AND PARAGRAPHS. Captions accompanying Specifications sections and paragraphs are for convenience of reference only, and do not form a part of the Specification.

B. APPLICABLE PUBLICATIONS. Whenever in these specifications references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is specified, only the latest specifications, standards or requirements of the respective issuing agencies which have been published as of the date that the work is advertised for bids, shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth herein or shown on the drawings shall be waived because of any provision of, or omission from, said standards or requirements.

C. SPECIALISTS, ASSIGNMENTS. In certain instances, specifications test requires (or implies) that specific work is to be assigned to specialists or expert entities, who must be engaged for the performance of that work. Such assignments shall be recognized as special requirements and shall not be interpreted so as to conflict with the enforcement of building codes and similar regulations governing the work; also they are not intended to interfere with local union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of work is recognized as "expert" for the indicated construction processes or operations. Nevertheless, the final responsibility for fulfillment of the entire set of contract requirements remains with CONTRACTOR.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of other requirements of the specifications, all work specified herein shall conform to or exceed the requirements of all applicable codes and the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of these Specifications nor the applicable codes.

B. Reference herein to "Building Code" or IBC shall mean the International Building Code of the International Conference of Building Officials (ICBO). The latest edition of the code as approved and used by the local agency as of the date of award, as adopted by the agency having jurisdiction, shall apply to the work herein, including all addenda, modifications, amendments, or other lawful changes thereto.

C. In case of conflict between codes, reference standards, drawings and the other Contract Document, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the ENGINEER for clarification and directions prior to ordering or providing any materials or labor. CONTRACTOR shall bid the most stringent requirements.

D. APPLICABLE STANDARD SPECIFICATIONS. CONTRACTOR shall construct the work specified herein in accordance with the requirements of the Contract Documents and the referenced portions of those referenced codes, standards, and specifications listed herein; except, that wherever references to "Standard Specifications" are made, the provisions therein for measurement and payment shall not apply.

E. References in the Contract Documents to "Standard Specifications" shall mean the Contract Documents including all current supplements, addenda, and revisions thereof.

F. References herein to "OSHA Regulations for Construction" shall mean Title 29, Part 1926, Construction Safety and Health Regulations, Code of Federal Regulations (OSHA), including all changes and amendments thereto.

G. References herein to "OSHA Standards" shall mean Title 29, Part 1910, Occupational Safety and Health Standards, Code of Federal Regulations (OSHA), including changes and amendments thereto.

H. UTAH STATE DIVISION OF WATER QUALITY. Wastewater Collection, Treatment and Disposal system design shall conform to the requirements of the Utah Administrative Code Rule, R317-3. Design Requirements for Wastewater Collection, Treatment and Disposal Systems.

I. Reference herein to APWA shall mean the latest edition of the “Manual of Standard Specifications” and “Manual of Standard Plans” as prepared by the American Public Works Association and the Associated General Contractors of America.

- END OF SECTION -

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 All work completed under this contract shall be in accordance with the Plans and Specifications and will be measured by the ENGINEER.

1.02 The term "Lump Sum" when used as an item of payment will mean complete payment for the work described in the contract. When a complete structure, portion of work, or unit is specified "Lump Sum" as the unit of measurement, the unit will include fittings, accessories, and all work necessary to complete the work as shown on the plans and as specified.

1.03 The OWNER reserves the right to add to or delete from quantities listed in the Schedule of Values in order to match the total bid with the budgeted money available.

1.04 Discounts and Sales Tax. CONTRACTOR shall maintain full responsibility for all materials and is to include all costs of materials and taxes as part of CONTRACTOR's bid.

PART 2 BID SCHEDULE

2.01 BID ITEM NO. 1 - "REHABILITATION OF EXISTING SEWER AND PUMPING STATIONS FOR GREAT SALT LAKE MARINA AND SALTAIR FACILITIES COMPLETE"

A. **METHOD OF MEASUREMENT:** This Bid Item shall not be measured, but shall be paid for on a lump sum basis for the completion of the work.

B. **BASIS OF PAYMENT:** Payment shall be made at the contract lump sum bid price. Payment shall be considered compensation for all labor, equipment, and materials necessary, including but not limited to excavation, draining and filling, removal and disposal of excavation materials, and all other incidentals and materials described herein and as shown on the drawings; furnishing the vaults, pumps, grinder pumps, and grinders pipe and all necessary fittings including bends, crosses, tees, plugs, sleeves and reducers to make a functional system; excavation; dewatering; shoring; installing the pipe, connections, thrust blocks and restraints, imported bedding and backfilling, compaction, cleaning, traffic control, restoration of all surface improvements; electrical systems; and all other operations and materials required to complete the work as herein described and as shown on the drawings.

- END OF SECTION -

SECTION 01210

PROJECT MEETINGS

PART 1 GENERAL

1.01 PRECONSTRUCTION CONFERENCE

A. Prior to the commencement of work at the site, a preconstruction conference will be held at a mutually agreed upon time and place which shall be attended by CONTRACTOR, its superintendent, and its subcontractors as appropriate. Other attendees will be:

1. ENGINEER and the Resident Project Representative (RPR).
2. Representatives of OWNER.
3. Governmental representatives as appropriate.
4. Others as requested by CONTRACTOR, OWNER, or ENGINEER.

B. Unless previously submitted to ENGINEER, CONTRACTOR shall bring to the conference one copy of each of the following:

1. Progress schedule.
2. Procurement schedule of major equipment and materials and items requiring long lead time.
3. Shop Drawings/Sample/Substitute "Or Accepted Equal" submittal schedule.

C. The purpose of the conference is to designate responsible personnel, define lines of communication and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The complete agenda will be furnished to CONTRACTOR prior to the meeting date, which may include the following:

1. CONTRACTOR's tentative schedules.
2. Transmittal, review, and distribution of CONTRACTOR's submittals.
3. Processing applications for payment.
4. Maintaining record documents.
5. Critical work sequencing.
6. Field decisions and Change Orders.
7. Use of project site, office and storage areas, security, housekeeping, and OWNER's needs.
8. Major equipment deliveries and priorities.
9. CONTRACTOR's assignments for safety and first aid.

D. ENGINEER will preside at the preconstruction conference and will arrange for keeping the minutes and distributing the minutes to all persons in attendance.

1.02 PROGRESS MEETINGS

A. CONTRACTOR shall schedule and hold regular on-site progress meetings at least weekly and at other times as required by ENGINEER or as required by progress of the work. CONTRACTOR, ENGINEER, and all subcontractors active on the site shall be represented at each meeting. CONTRACTOR may at its discretion request attendance by representatives of its suppliers, manufacturers, and other subcontractors.

B. ENGINEER or owner shall preside at the meetings and provide for keeping and distribution of the minutes. The purpose of the meetings will be to review the progress of the work, maintain coordination of efforts, discuss changes in scheduling, and resolve other problems which may develop.

C. At each construction progress meeting a progress report shall be presented by the CONTRACTOR containing an updated Progress Schedule. Where the delayed completion data of a project phase is noted, the Contractor shall describe the anticipated delays or problems and outline the action plan being taken to counter their effect.

1.03 MEASUREMENT AND PAYMENT

A. Project Meetings shall not be measured or paid as a separate item, but shall be included as part of the Lump Sum Cost.

- END OF SECTION -

SECTION 01292

SCHEDULE OF VALUES

PART 1 GENERAL

1.01 SUMMARY

A. This section covers preparation and submittal of a Schedule of Values for lump sum contract for evaluating progress payment requests and change orders.

1.02 DEFINITIONS

A. The Schedule of Values is an itemized list that establishes the value of each part of the Work for a lump sum contract. The Schedule of Values is used as the basis for preparing applications for payments. Quantities and unit prices may be included in the Schedule when designated by the ENGINEER.

B. The items to be listed include each of the items listed under “Description” in the lump sum Bid Schedule.

1.03 PREPARATION

A. Subdivide the Schedule of Values into logical portions of the Work, such as major work items or work in contiguous geographic areas. The items in the Schedule of Values will correlate directly with the tasks enumerated in the lump sum Bid Schedule. Then organize each portion using the Table of Contents of these Specifications as an outline for listing the value of work by Major Sections of the Work. A pro rata share of mobilization, bonds, and insurance may be listed as separate items for each portion of the work.

B. Items should include a proportional share of Contractor's overhead and profit so that the total of all items will equal the Contract Price.

C. For lump sum equipment items where submittal of operation/maintenance data and testing are required, include equipment operation and maintenance data submittal and Operations and Maintenance Manual with each equipment item. Show required startup testing and training separately.

D. Round off figures for each listed item to the nearest $50.00 except for the value of one item, if necessary, to make the total of all items in the Schedule of Values equal the Contract Price for the lump sum contract amount of the Bid.

E. Type the Schedule of Values on 8-1/2-inch by 11-inch white bond paper.

1.04 SUBMITTAL

A. Submit the Schedule of Values in accordance with the requirements of Section 01300 – Contractor Submittals, within 21 calendar days of Notice to Proceed.

B. Revise the Schedule of Values and resubmit for items affected by contract modifications, change orders, and work change directives. After the changes are reviewed without exception by the ENGINEER, make the submittal at least 14 calendar days prior to submitting the next application for progress payment.

1.05 MEASUREMENT AND PAYMENT

A. Schedule of Values shall not be measured or paid as a separate item, but shall be included as part of the Lump Sum Cost.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01300

CONTRACTOR SUBMITTALS

PART 1 GENERAL

1.01 SHOP DRAWING SUBMITTAL

A. CONTRACTOR shall furnish to the ENGINEER for review, 4 copies of each shop drawing submittal. The term "Shop Drawings" as used herein shall be understood to include detail design calculations, shop drawings, fabrication and installation drawings, erection drawings, list, graphs, operating instructions, catalog sheets, data sheets, and similar items. Shop drawings and submittal requirements shall include interpretations of proposed or required configurations not shown on the drawings, so as a document record of such can be approved.

B. Drawings shall be submitted sufficiently in advance to allow the ENGINEER not less than ten regular working days for examining the drawings. These drawings shall be accurate, distinct, and complete and shall contain all required information, including satisfactory identification of items and unit assemblies in relation to the contract drawings and/or specifications.

C. When the shop drawings are approved by the ENGINEER, two sets of prints will be returned to CONTRACTOR marked "Accepted", "Accepted, Except as Noted", or similar notification. If changes or corrections are necessary, one set will be returned to CONTRACTOR with such changes or corrections, indicated by a brief statement, and CONTRACTOR shall correct and resubmit the drawings, in triplicate, when requested by the ENGINEER.

D. Acceptance of shop drawings will not be required of reinforcing steel that is detailed by CONTRACTOR in accordance with the plans and specifications. Any change from the plans and specifications that is made by CONTRACTOR in reinforcing steel, as well as any other change shall be approved by the ENGINEER in a written change order prior to any work being altered from that already approved for construction.

E. Fabrication of an item may be commenced only after the ENGINEER has reviewed the pertinent submittals and returned copies to CONTRACTOR marked either "Accepted", or "Accepted - Except as Noted". Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis of claims for extra work.

F. All CONTRACTOR shop drawing submittals shall be carefully reviewed by an authorized representative of CONTRACTOR, prior to submission to the ENGINEER.

G. The ENGINEER's review of CONTRACTOR shop drawing submittals shall not relieve CONTRACTOR of the entire responsibility for the corrections of details and dimensions. CONTRACTOR shall assume all responsibility and risk for any misfits due to any errors in CONTRACTOR submittals. CONTRACTOR shall be responsible for dimensions and the design of adequate connections and details.

1.02 SAMPLES SUBMITTAL

A. Whenever requested of the ENGINEER, CONTRACTOR shall submit at least 1 sample of each item or material to the ENGINEER for acceptance at no additional cost to OWNER.

B. Samples, as required herein, shall be submitted for acceptance prior to ordering such material for delivery to the jobsite, and shall be submitted in an orderly sequence so that dependent materials or equipment can be assembled and reviewed without causing delay in the Work.

C. Unless otherwise specified, all colors and textures of specified items will be selected by the ENGINEER from the manufacturer's standard colors and standard materials, products, or equipment lines.

1.03 OPERATIONS AND MAINTENANCE MANUAL SUBMITTAL

A. The CONTRACTOR shall furnish to the Engineer 4 (four) identical sets of Operations and Maintenance Manuals. Each set shall consist of one or more volumes, each of which shall be bound in a standard size, 3-ring, loose-leaf, vinyl, hard-cover binder suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches. Large Manuals shall be in more than one volume. A Table of Contents shall be provided which indicates all equipment in the Operations and Maintenance Manuals.

B. The CONTRACTOR shall include in the Operations and Maintenance manuals full details for care and maintenance for all visible surfaces as well as the following for each item of mechanical, electrical, and instrumentation equipment (except for equipment furnished by the OWNER):

1. Complete operating instructions, including location of controls, special tools or other equipment required, related instrumentation, and other equipment needed for operation.

2. Preventative maintenance procedures and schedules.

3. Complete parts lists, by generic title, identification number, and catalog number, complete with exploded views of each assembly.

4. Disassembly and reassembly instruction.

5. Name and location of nearest supplier and spare parts warehouse.

6. Name and location of manufacturer.

7. Recommended troubleshooting and start-up procedures.

8. Prints of the record drawings, including diagrams and schematics, as required under the electrical and instrumentation portions of these specifications.

C. All Operations and Maintenance manuals shall be submitted in final form to the ENGINEER not later than the 75 percent of construction completion date. All discrepancies found by the Engineer in the Operations and Maintenance manuals shall be corrected by the CONTRACTOR prior to final acceptance of the project.

1.04 PROGRESS SCHEDULE SUBMITTAL

A. The CONTRACTOR shall prepare a project progress schedule using the Critical Path Method, and meeting the following requirements:

1. Minimum Sheet Size: as required to show appropriate level of detail.

2. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

3. Provide separate schedule of submittal dates for shop drawings, product data, and samples.

4. Submit revised Progress Schedule with each Application for Payment.

1.05 MEASUREMENT AND PAYMENT

A. CONTRACTOR submittals shall not be measured or paid as a separate item, but shall be included as part of the lump sum cost.

- END OF SECTION -

SECTION 01440

QUALITY CONTROL & MATERIALS TESTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Responsibilities for controlling quality of materials, products and workmanship.

B. Responsibilities for manufacturer's instructions, certificates and field service.

1.02 MATERIALS

A. All materials incorporated in the project shall be new and shall fully comply with the specifications. Unless otherwise clearly provided in the specifications, all workmanship, equipment, materials, and articles incorporated in the work covered by the contract are to be of the best available grade of their respective kinds. Whenever, in the specifications, any material, article, device, product, fixture, form, type of construction, or process indicated or specified by patent or proprietary name, by name of manufacturer, or by catalog number, such specifications shall be deemed to be used for the purpose of establishing a standard of quality and facilitating the description of the material or process desired and shall be deemed to be followed by the words "or accepted equal" and CONTRACTOR may in such case, upon receiving the ENGINEER's approval, purchase and use any item, type, or process that shall be substantially equal in every respect to that indicated or specified.

B. Materials and equipment may be used in the Work based upon receipt of a Supplier's certificate of compliance. Certificate must be in possession of CONTRACTOR and reviewed by ENGINEER prior to use.

C. Quality Assurance Testing by the OWNER and/or ENGINEER shall not relieve CONTRACTOR of responsibility to furnish materials and work in full compliance with Contract Documents.

1.03 MANUFACTURER'S INSTRUCTIONS

A. Should instructions conflict with Contract Documents, request clarification before proceeding.

B. When required in individual sections, submit manufacturer's instructions in the quantity required for product data, delivery, handling, storage, assembly, installation, start-up, adjusting, balancing, and finishing, as appropriate.

1.04 MANUFACTURER'S CERTIFICATES

A. When required in individual sections, submit manufacturer's certificate in duplicate executed by responsible officer certifying that product meets or exceeds specified requirements.

1.05 MANUFACTURER'S FIELD SERVICES

A. When required in individual sections, have manufacturer or Supplier provide qualified representative to observe field conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance of equipment as applicable and to make written report of observations and recommendations to ENGINEER.

1.06 WORKMANSHIP

A. Maintain performance control and supervision over Subcontractors, Suppliers, manufacturer's, products, services, workmanship, and site conditions, to produce work in accordance with Contract Documents.

B. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

C. Provide suitable qualified personnel to produce specified quality.

D. Ensure finishes match approved samples.

1.07 INSPECTION OF MATERIALS

A. At the option of the ENGINEER, materials to be supplied under this contract will be tested and/or inspected either at their place of origin or at the site of the work. CONTRACTOR shall give the ENGINEER written notification well in advance of actual readiness of materials to be tested and/or inspected at point of origin. Satisfactory tests and inspections at the point of origin shall not be construed as a final acceptance of the material nor shall it preclude retesting or re-inspection at the site of the work.

B. CONTRACTOR shall furnish such samples of materials as are requested by the ENGINEER, without charge. No material shall be used until it has been approved by the ENGINEER. See Section 01300, CONTRACTOR Submittals.

1.08 UNSATISFACTORY CONDITIONS

A. Contractor shall examine areas and conditions under which materials and products are to be installed. Contractor shall not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.

1.09 QUALITY CONTROL TESTING

A. ENGINEER's failure to detect any defective Work or materials does not prevent later rejection when such defect is discovered nor does it obligate ENGINEER for acceptance.

B. CONTRACTOR shall provide 24-hours minimum notice to ENGINEER and OWNER for all testing required by these specifications.

1.10 TESTING ACCEPTANCE AND FREQUENCY

A. Minimum Quality Control Testing Frequency: The minimum quality control and testing frequency is defined in Table 01440-1 below. The CONTRACTOR shall be responsible to ensure that testing is performed at the frequencies shown. CONTRACTOR shall uncover any work at no cost to OWNER to allow OWNER to perform required testing at the frequencies shown.

TABLE 01440-1: QUALITY CONTROL TESTING FREQUENCY

SYSTEM or MATERIAL	TESTS	MINIMUM REQUIRED FREQUENCY
SUBGRADE AND BACKFILL MATERIALS		
Section 02221 Excavation and Backfill for Buried Pipelines	Field Density *	1 test per 300 linear feet per 1.5 feet of backfill thickness placed, and no less than one test per 1.5 feet of backfill per excavation site.
	Laboratory	1 test for each material type which includes proctor, classification and gradation.
Section 02222 Excavation and Backfill for Structures	Field Density *	1 test per 300 linear feet per 1.5 feet of backfill thickness placed.
	Laboratory	1 test for each material type which includes proctor, classification and gradation.
	Laboratory	Base course: 1 test for each material type which includes proctor, classification and gradation.
ASPHALT		
Section 02500 Removal and Replacement of Surface Improvements	Mix Design	Marshall Test Method: 1 test initially per each type of material and each change in target, and for each day of production thereafter. Specific Gravity: 1 per each Marshall Test Extraction: 1 test per each Marshall Test
	Field Density *	Bituminous surfaces: 1 test per 8,000 square feet placed or part thereof.
	Asphalt Thickness and Core Density	Bituminous surfaces: 1 test sample every 300 linear feet of completed roadway patch.

PORTLAND CEMENT CONCRETE		
Section 03300 Cast-in-Place Concrete	Slump	1 test every day of placement or 1 test for every 50 cubic yards and more frequently if batching appears inconsistent. Conduct with strength tests.
	Entrained air	1 test with slump test.
	Ambient and concrete tem-peratures	1 test with slump test.
	Water cement ratio.	to be verified and provided with batch tickets.
	Compressive strength	1 set of 4 cylinders every 50 c.y. or part thereof per day.

NOTES:

1 Additional tests shall be conducted when variations occur due to the contractor's operations, weather conditions, site conditions, etc.

2 Classification, moisture content, Atterberg limits and specific gravity tests shall be conducted for each compaction test if applicable.

3 Tests can substitute for same tests required under "Aggregates" (from bins or source), although gradations will be required when blending aggregates.

4 Aggregate moisture tests are to be conducted in conjunction with concrete strength tests for water/cement calculations.

5. * All nuclear density meters used for in place field testing shall have been calibrated by ASTM methods within 1 year previous to current testing.

- END OF SECTION -

SECTION 01500

TEMPORARY CONSTRUCTION UTILITIES AND ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.01 DESCRIPTION

A. This section covers temporary utilities, including electricity, lighting, telephone service, water, and sanitary facilities; temporary controls, including barriers, protection of work, and water control; and construction facilities, including parking, progress cleaning, and temporary buildings.

1.02 TEMPORARY UTILITIES

A. Temporary Electricity: CONTRACTOR shall provide, maintain, and pay for all power required by CONTRACTOR, including electrical service to CONTRACTORS field office.

B. Temporary Lighting: CONTRACTOR shall provide all temporary lighting required for prosecution of his work and for employee and public safety. As a minimum, lighting levels during working hours shall meet the requirements of U.O.S.H.A. Subsection 1926.56 Illumination.

C. Telephone Service: CONTRACTOR shall provide, maintain and pay for telephone service to the field office.

D. Temporary Water Service

1. CONTRACTOR shall provide for all his workers on the project, adequate and reasonably convenient uncontaminated drinking water supply. All facilities shall comply with the regulations of the local and Utah State Departments of Health.

2. CONTRACTOR shall be responsible to arrange for water, both potable and non-potable water.

3. When water is taken from a city water system or any other potable water supply source for construction purposes, suitable precautions shall be taken to prevent cross connections and contamination of water supply.

E. Temporary Sanitary Facilities: CONTRACTOR shall provide and maintain sanitary facilities for his employees and his subcontractors' employees that will comply with the regulations of the local and Utah State Departments of Health.

1.03 TEMPORARY CONTROLS

A. Barriers: Provide barriers as necessary to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.

B. Dust Control: Execute Work using methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into the atmosphere. Give all unpaved streets, roads, detours, or haul roads used in the construction area an approved dust-preventive treatment or periodically water to prevent dust. Applicable environmental regulations for dust prevention shall be strictly enforced. **CONTRACTOR shall submit a Fugitive Dust Control Plan to the Division of Air Quality that meets all Utah State Administrative Code requirements (R307-309-4).**

C. Protection of Work: CONTRACTOR shall protect installed work and provide special protection where specified in individual specifications sections. CONTRACTOR shall provide temporary and removable protection for installed products, and shall control activity in immediate work area to minimize damage.

D. Open Burning: No open burning of waste materials will be allowed.

E. Explosives and Blasting: The use of explosives on the work will not be permitted.

F. Noise Abatement: In inhabited areas, particularly residential, operations shall be performed in a manner to minimize unnecessary noise generation.

G. Storm & Ground Water

1. CONTRACTOR shall provide and maintain at all times during construction, ample means and devices with which to promptly remove and properly dispose of all water entering the excavation or other parts of the work, whether the water be surface or underground water.

2. In excavation, fill, and grading operations, care shall be taken to disturb the pre-existing drainage pattern as little as possible. Particular care shall be taken not to direct drainage water into private property or into streets or drainage ways inadequate for the increased flow.

3. CONTRACTOR shall maintain effective means to minimize the quantity of sediments leaving the work area either by storm water or CONTRACTOR's own dewatering operations.

4. Contractor shall prepare Notice of Intent (NOI), submit to the OWNER, get it signed by the OWNER and then submit to the Utah State Department of Water Quality for permitting of storm water discharge under Utah Pollution Discharge and Elimination System (UPDES).

5. Contractor shall prepare, maintain, and keep a copy of Storm Water Pollution Prevention Plan (SWPPP) on site at all times during construction and perform inspection and maintenance of designated Best Management Practices (BMP's) as required under UPDES.

H. Traffic Control: shall be the responsibility of the CONTRACTOR along any road where potential exists for traffic disruption. CONTRACTOR shall assume responsibility for materials (including barricades, flagging, signage, personnel safety equipment, etc., including storage and handling of materials), labor, equipment and incidentals required to control traffic flow for the duration of the project in accordance with all applicable local, state and federal regulations. The CONTRACTOR shall be responsible to obtain a traffic control permit from the City, and have such permit in place prior to beginning any work which impacts traffic.

1.04 CONSTRUCTION FACILITIES

A. Parking: CONTRACTOR shall provide temporary parking areas to accommodate use of construction personnel. Parking shall be located in an area approved by the ENGINEER.

B. Progress Cleaning

1. CONTRACTOR shall maintain areas free of waste materials, debris, and rubbish. Maintain the site in a clean and orderly condition. Upon completion of work, repair all damage caused by equipment and leave the project free of rubbish or excess materials of any kind.

2. Thoroughly clean all spilled dirt, gravel, or other foreign materials caused by the construction operations from all streets and roads at the conclusion of each day's operation.

3. It shall be the responsibility of CONTRACTOR to promptly clean up and remove any oil and or fuel spills caused by CONTRACTOR or his Sub-contractors during the course of the project. Contaminated soil shall be properly disposed of by CONTRACTOR in accordance with all applicable laws. CONTRACTOR shall be responsible for any damages to OWNER resulting from CONTRACTOR's negligence in promptly cleaning up said spills.

1.05 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Prior to Final Application for Payment, CONTRACTOR shall remove temporary above grade or buried utilities, equipment, facilities, and materials; clean and repair damage caused by installation or use of temporary work; and restore existing facilities used during construction to original condition.

1.06 CHEMICALS

A. All chemicals used during construction or furnished for project operation whether defoliant, soil sterilant, herbicide, pesticide, disinfectant, polymer, reactant or of other classification, shall show approval of the U.S. Department of Agriculture. Use of all such chemicals and disposal of residues shall be in strict accordance with the printed instruction of the manufacturer.

1.07 CULTURAL RESOURCES

A. The CONTRACTOR's attention is directed to the National Historic Prevention Act of 1966 (16 U.S.C. 470) and 36 CFR 800 which provides for the preservation of potential historical architectural, archeological, or cultural resources (hereinafter called "cultural resources").

B. The CONTRACTOR shall conform to the applicable requirements of the National Historic Preservation Act of 1966 as it relates to the preservation of cultural resources.

C. In the event potential cultural resources are discovered during subsurface excavations at the site of construction, the following procedures shall be instituted:

1. The ENGINEER will issue a Field Order directing the CONTRACTOR to cease all construction operations at the location of such potential cultural resources find.

2. Such Field Order shall be effective until such time as a qualified archeologist can be called to assess the value of these potential cultural resources and make recommendations to the OWNER and ENGINEER.

D. If the archeologist determines that the potential find is a bona fide cultural resource, at the direction of the ENGINEER, the CONTRACTOR shall suspend work at the location of the find under the provisions for changes contained in the Contract.

1.08 MEASUREMENT AND PAYMENT

A. Temporary Construction Utilities and Facilities shall not be measured or paid as a separate item, but shall be included as part of the Lump Sum cost.

- END OF SECTION -

SECTION 01501

TEMPORARY SEWER MANAGEMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. This section covers temporary sewer management for OWNER facilities during construction including, but not limited to, removal or treatment of sewage flows from OWNER facilities; providing power, providing labor, maintenance, etc. required to operate such facilities to ensure uninterrupted sewer service to OWNER's facilities.

1.02 TEMPORARY SEWER SERVICE

A. CONTRACTOR shall select appropriate measures to ensure sewer service to OWNER's facilities, or other facilities currently served by the sewer force main or pump stations, affected by work during project period. CONTRACTOR shall report in writing to OWNER any anticipated lapse in service in establishing temporary sewer service no later than 24 hours prior to the beginning of the lapse in service. Notice shall include start date and expected completion time and date of service lapse.

1.03 MEASUREMENT AND PAYMENT

A. Temporary sewer maintenance shall be measured and paid as part of the Lump Sum cost and shall include facilities, utilities, maintenance, labor, equipment, etc. used to maintain sewer service to OWNER's facilities during construction.

- END OF SECTION -

SECTION 01505

MOBILIZATION

PART 1 GENERAL

1.01 GENERAL

A. This Section is provided to cover CONTRACTOR's cost of general and miscellaneous responsibilities and operations not normally attributed to, or included in, any other single bid item. This shall include, but not necessarily be limited to, work described or enumerated in this section under the following subsections.

1.02 MOVING TO AND FROM THE JOB SITE

A. This shall include CONTRACTOR's preliminary arrangement for starting and stopping construction operations, work schedules, and transportation of equipment and personnel to and from the project.

1.03 CLEAN-UP

A. The cost of all clean-up work as specified and not covered under other items shall be included in the lump-sum cost.

1.04 TEMPORARY UTILITIES

A. The cost of water, power, etc. required by CONTRACTOR in performing the work specified in the contract shall be included in the lump-sum price for "Mobilization".

1.05 PERFORMANCE BOND, PAYMENT BOND, AND INSURANCE

A. The cost of the performance bond, payment bond, and any required insurance and/or other miscellaneous cost associated with this project that is not found on the Bid Schedule shall be shown under mobilization in the Schedule of Values and included in the Lump Sum Cost.

1.06 TEMPORARY FACILITIES

A. CONTRACTOR shall provide and maintain a temporary field office on the project or within 20 miles of the project limits.

B. CONTRACTOR shall provide for all his workers on the project, adequate and reasonably convenient uncontaminated drinking water supply and temporary toilet facilities. All facilities shall comply with the Utah Safety and Health Act; the locations of which shall be clearly marked on the Storm Water Pollution Prevention Plan.

C. CONTRACTOR shall make arrangements for, secure, and pay for any and all utility supplies such as electric power, water, natural gas, or telephone that may be required for prosecution of the work.

D. CONTRACTOR shall provide all temporary lighting required for prosecution of his work and for employee and public safety. As a minimum, lighting levels during working hours shall meet the requirements of U.O.S.H.A. Subsection 1926.56 illumination.

1.07 ENGINEER'S OFFICE

A. CONTRACTOR is not required to supply an ENGINEER's Office.

1.08 PERMITS

A. CONTRACTOR shall provide all necessary permits for completion of the work.

1.09 MEASUREMENT AND PAYMENT

A. Mobilization shall not be measured or paid as a separate item, but shall be included as part of the Lump Sum Cost.

--END OF SECTION--

SECTION 01530

PROTECTION OF EXISTING FACILITIES

1.01 GENERAL

A. Any existing facilities disturbed which are located in or adjacent to the line of work such as curbs, gutters, drive approaches, sidewalks, driveways, fences, underground pipes, conduits, or utilities, shall be cleaned up and restored in kind by the CONTRACTOR and in accordance with the specifications contained herein governing the various types of services involved.

1.02 RESTORATION OF FENCES

A. Where it is necessary to remove any fence to facilitate the CONTRACTOR's operation, the CONTRACTOR shall obtain prior agreement with the OWNER for removal of the fence, and shall be responsible for any damage due to negligence of the CONTRACTOR. As soon as practical, the fence shall be restored substantially to the same or improved condition as it was prior to the commencement of the work. Where livestock is present the CONTRACTOR shall provide temporary fencing to keep livestock away from the construction area.

1.03 INTERFERING STRUCTURES AND UTILITIES

A. The CONTRACTOR shall exercise all possible caution to prevent damage to existing structures and utilities, whether above ground or underground. It shall be the responsibility of the CONTRACTOR to locate and expose all existing underground and overhead structures and utilities in such a manner as to prevent damage to same. The CONTRACTOR shall notify all utility offices concerned at least 48 hours in advance of construction operations in which a utility agency's facilities may be involved. This shall include, but not be limited to, irrigation water, culinary water, sanitary sewer, telephone, gas, and electric. The CONTRACTOR shall be responsible for any and all changes to, reconnections to public utility facilities encountered or interrupted during prosecution of the work, and all costs relating hereto shall be at the CONTRACTOR's expense. The CONTRACTOR shall contract with and pay Public Utility Agencies for work required in connection with all utility interferences and handle all necessary notifications, scheduling, coordination, and details. The cost of public utility interferences shall be included in the CONTRACTOR's lump sum or unit price bid covering the major contract facility to which interference or changes are attributable.

B. Any damages to private property, either inside or outside the limits of the easements provided by the OWNER, shall be the responsibility of the CONTRACTOR. Any roads, structures, or utilities damaged by the work shall be repaired or replaced in a condition equal to or better than the condition prior to the damage. Such repair or replacement shall be accomplished at the CONTRACTOR's expense without additional compensation from the OWNER.

C. The CONTRACTOR shall remove and replace small miscellaneous structures such as fences and culverts which are damaged by the construction activity at his own expense without additional compensation from the OWNER. The CONTRACTOR shall replace these structures in a condition as good as or better than their original condition.

D. The CONTRACTOR shall saw cut the edge of existing drive approaches, where necessary, to prevent their damage during removal and replacement of the adjacent asphalt surface. Drive approaches which are damaged by the construction activity shall be repaired by the CONTRACTOR at his own expense without additional compensation from the OWNER. The CONTRACTOR shall replace these structures in a condition as good as or better than their original condition.

E. At points where the CONTRACTOR's operations are adjacent to or across properties of railway, telegraph, telephone, irrigation canal, power, gas, water, or adjacent to other property (damage to which might result in considerable expense, loss, and inconvenience), no work shall be started until all arrangements necessary for the protection thereof have been made.

F. The locations of the major existing culinary water lines, gas pipes, underground electric, cable television, and telephone lines that are shown on the plans, were taken from city maps, and maps supplied by the utility owner. Preliminary investigations have indicated they are generally reliable. However, it should be expected that some location discrepancies will occur. Neither the OWNER nor its officers or agents shall be responsible for damages to the CONTRACTOR as a result of the locations of the utilities being other than those shown on the plans or for the existence of utilities not shown on the plans.

G. The CONTRACTOR shall be solely and directly responsible to the owners and operators of such properties for any damage, injury, expense, loss or inconvenience, delay, suits, actions, or claims of any character brought because of an injury or damage which may result from the carrying out of the work to be done under the contract.

H. In the event of interruption to either domestic or irrigation water, or to other utility services as a result of accidental breakage, or as a result of being exposed or unsupported, the CONTRACTOR shall promptly notify the proper authority. The CONTRACTOR shall cooperate with the authority in restoration of service as soon as possible, and shall not allow interruption of any water or utility service outside working hours unless prior approval is received.

I. Existing drainage ditches are owned and operated by a third party; not the OWNER. These drainage ditches must be maintained by the CONTRACTOR during construction. Where these drainage ditches must be crossed for utility installation, they must be restored upon completion to their existing condition (See Section 02500 - Removal and Replacement of Surface Improvements). The CONTRACTOR shall consult with ENGINEER if conflicts or questions arise during construction.

1.04 RIGHTS-OF-WAY

A. The property is owned by the OWNER or the STATE; therefore no rights-of-way are required.

1.05 MEASUREMENT AND PAYMENT

A. Protection of existing facilities shall not be measured or paid as a separate item, but shall be included as part of the Lump Sum Cost.

- END OF SECTION -

SECTION 01550

JOB CONDITIONS

PART 1 GENERAL

1.01 SITE INVESTIGATION

A. CONTRACTOR acknowledges that he has satisfied himself as to the nature and location of the work; the general and local conditions, particularly those bearing upon availability of transportation, access to the site, disposal, handling and storage of materials, availability of labor, water, electric power, roads, and uncertainties of weather, river stages, or similar physical conditions at the site; the conformation and conditions of the ground; the character of equipment and facilities needed preliminary to and during the prosecution of the work; and all other matters which can in any way affect the work or the cost thereof under this Contract.

1. CONTRACTOR further acknowledges that he has satisfied himself as to the character, quality, and quantity of surface and subsurface materials to be encountered from his inspection of the site and from reviewing any available records of exploratory work furnished by OWNER or included in these Documents. Failure by CONTRACTOR to acquaint himself with the physical conditions of the site and all the available information will not relieve him from responsibility for properly estimating the difficulty or cost of successfully performing the work.

2. CONTRACTOR warrants that as a result of his examination and investigation of all the aforesaid data that he can perform the work in a good and workmanlike manner and to the satisfaction of OWNER. OWNER assumes no responsibility for any representations made by any of its officers or agents during or prior to the execution of this Contract, unless (1) such representations are expressly stated in the Contract, and (2) the Contract expressly provides that the responsibility therefore is assumed by OWNER.

B. STREET USE. Nothing herein shall be construed to entitle CONTRACTOR to the exclusive use of any public street, alleyway, or parking area during the performance of the work hereunder, and CONTRACTOR shall so conduct operations as not to interfere unnecessarily with the authorized work of utility companies or other agencies in such streets, alleyways, or parking areas. No street shall be closed to the public without first obtaining written permission of the ENGINEER and proper governmental authority.

C. SALTAIR FACILTY. Contractor shall conduct his work in a clean and safe manner, and preserve access to the Saltair Facility at all times. The scheduling of work, excavation and trenching shall be coordinated with both the OWNER and the tenant of the Saltair building. The CONTRACTOR shall conduct his work in such a way as to minimize loss of parking spaces, and maintain safety barricades around the work, when on the Saltair property. Any trenches shall be backfilled or plated with 1" thick steel trench plates whenever the tenant of the Saltair building informs the CONTRACTOR that a concert will be taking place.

1.02 CONTRACTOR'S WORK AND STORAGE AREA

A. CONTRACTOR shall make arrangements for any offsite storage or shop areas necessary for the proper execution of the work.

1.03 MEASUREMENT AND PAYMENT

A. Job conditions shall not be measured or paid as a separate item, but shall be included as part of the Lump Sum Cost.

- END OF SECTION -

SECTION 01570

TRAFFIC CONTROL

PART 1 GENERAL

1.01 GENERAL

A. The CONTRACTOR shall comply with all rules and regulations of the City, County, and State authorities regarding the closing of public streets or highways. If conditions justify, the ENGINEER may authorize the CONTRACTOR to conduct his work in specific areas and to specific tasks to avoid sporadic and unorganized work efforts.

B. All work performed on or within the right-of-way of state roads shall have traffic control devices in place before work begins that meet the requirements of Utah Department of Transportation's "Specifications for Excavation on State Highways"

C. No road shall be closed by the CONTRACTOR to the public except by express permission of the Agency. Where it is necessary to close a county or city road to thru traffic, the road shall be closed to thru traffic only - not local traffic. The road shall be closed for one block only, not over 700 feet. The road shall be barricaded at each point of public access with approved barricades

D. Traffic must be kept open on those roads and streets where no detour is possible. The CONTRACTOR shall, at all times, conduct his work so as to insure the least possible obstruction to traffic and normal commercial pursuits. All obstructions within traveled roadways shall be protected by approved signs, barricades, and lights where necessary for the safety of the traveling public. The convenience of the general public and residents, and the protection of persons and property is of prime importance and shall be provided for by the CONTRACTOR in an adequate and satisfactory manner.

E. Excavations on project sites from which the public is excluded shall be marked or guarded in a manner appropriate for the hazard.

1.02 TRAFFIC CONTROL

A. For the protection of traffic in public or private streets and ways, the CONTRACTOR shall provide, place, and maintain all necessary barricades, traffic cones, warning signs, lights, and other safety devices in accordance with the requirements of the "Manual of Uniform Traffic Control Devices, Part VI - Traffic Controls for Street and Highway Construction and Maintenance Operations," published by U.S. Department of Transportation, Federal Highway Administration (ANSI D6.1). The

CONTRACTOR shall take all necessary precautions for the protection of the work and the safety of the public. All barricades and obstructions shall be illuminated at night, and all lights shall be kept lit from sunset until sunrise. The CONTRACTOR shall station such guards or flaggers and shall conform to such special safety regulations relating to traffic control as may be required by the public authorities within their respective jurisdictions. All signs, signals, and barricades shall conform to the requirements of Subpart G, Part 1926, of the OSHA Safety and Health Standards for Construction.

B. If at any time the conditions indicate that the CONTRACTOR's protective facilities and service are inadequate to assure the safety of the public or the CONTRACTOR's workers, the CONTRACTOR shall provide additional facilities of services as may be necessary to assure protection at no additional cost to the OWNER.

- END OF SECTION -

SECTION 01700

PROJECT CLOSEOUT

PART 1 GENERAL

1.01 FINAL CLEANUP

A. CONTRACTOR shall promptly remove from the vicinity of the completed work, all rubbish, unused materials, concrete forms, construction equipment, and temporary structures and facilities used during construction. Final acceptance of the work by OWNER will be withheld until CONTRACTOR has satisfactorily complied with the foregoing requirements for final cleanup of the project site.

1.02 TOUCH-UP AND REPAIR

A. CONTRACTOR shall touch up or repair all finished surfaces on structures, fences, equipment, fixtures, or whatever, that have been damaged prior to final acceptance. Surfaces on which such touch-up or repair cannot be successfully accomplished shall be completely refinished or in the case of hardware and similar small items, the item shall be replaced.

1.03 CLOSEOUT TIMETABLE

A. CONTRACTOR shall establish dates for equipment testing, acceptance periods and on-site instructional periods (as required under the Contract). Such dates shall be established not less than one week prior to beginning any of the foregoing items, to allow OWNER, the ENGINEER, and their authorized representatives sufficient time to schedule attendance at such activities.

1.04 OPERATION AND MAINTENANCE MANUAL SUBMITTALS

A. CONTRACTOR's attention is directed to the condition that any monies due CONTRACTOR as progress payments shall be retained if, at the 75 percent construction completion point, the approved technical manuals have not been submitted in accordance with Section 01300 entitled "Contractor Submittals" of the Technical Specification. The aforementioned amount will be retained by OWNER until the technical manuals have been submitted. Any such retention of money for failure to submit the approved technical manuals on or before the 75 percent construction completion point shall be in addition to the retention of any payments due to CONTRACTOR as specified in Article 8 of the General Conditions.

1.05 MAINTENANCE AND GUARANTEE

A. CONTRACTOR shall comply with the maintenance and guarantee requirements contained in Article 9 of the General Conditions.

B. Replacement of earth fill or backfill, where it has settled below the required finish elevations, shall be considered as part of such required repair work, and any repair or resurfacing which becomes necessary by reason of such required repair work shall be completed by CONTRACTOR at no cost to OWNER.

C. CONTRACTOR shall make all repairs and replacements promptly upon receipt of written order from OWNER. If CONTRACTOR fails to make such repairs or replacement promptly, OWNER reserves the right to do the work and CONTRACTOR and his surety shall be liable to OWNER for the cost thereof.

D. The CONTRACTOR shall obtain a signed release from the property owner approving restoration of work in the construction easements across or bordering private property.

1.06 FINAL ACCEPTANCE

A. Final acceptance and final payment shall not be made until all provisions of the General Conditions Article 8 have been satisfied.

1.07 MEASUREMENT AND PAYMENT

A. Project closeout shall not be measured or paid as a separate item, but shall be included as part of the Lump Sum Cost.

- END OF SECTION -

DIVISION 2 - SITEWORK

SECTION 02000

GENERAL

PART 1 GENERAL

1.01 SCOPE

A. For the rehabilitation of the existing wastewater system as described herein or shown on the drawings, the following shall be provided: labor, materials, and equipment necessary for the earthwork, concrete work, piping and fittings, pumps, etc.

B. Additionally, the following services shall be provided: excavation, backfilling, shoring, dewatering, and compaction, etc. Backfill shall be selected for bedding and replacement of surface improvements. All work completed under this contract shall be in accordance with the Plans and Specifications and will be prepared by the ENGINEER.

- END OF SECTION -

SECTION 02110

CLEARING, GRUBBING AND STRIPPING

PART 1 GENERAL

1.01 SUMMARY

A. This work shall consist of removing and disposing of all trees; shrubs; brush; stumps; windfalls; roots; and other vegetation, including dead and decayed matter; and debris that exist within the designated construction limits, borrow areas, and soil stockpile areas and which are not specifically designated to remain.

1.02 DEFINITIONS

A. Clearing: Clearing operations shall consist of cutting, removing and disposing of trees, shrubs, bushes, windfalls and other vegetation within the construction limits, borrow areas, soil stockpile areas and for areas for digging insertion pits (entry access ports). All brush shall be cut off within six inches of the ground surface. All existing piles of vegetative debris will also be properly disposed of.

B. Grubbing: Grubbing operations shall consist of removing and disposing of stumps, roots, debris deleterious materials, and other remains (such as organic and metallic materials) which if left in place would interfere with proper performance or completion of the contemplated work, would impair its subsequent use or form obstructions therein. Organic material from clearing or grubbing operations shall not be incorporated in fill or backfill.

C. Stripping: Stripping operations shall consist of removing all soil material containing sod, grass, or other vegetation and topsoil to a minimum depth of six (6) inches from all areas that will receive fill or over all trenches in field or yard areas.

1.03 MEASUREMENT AND PAYMENT

Measurement and payment for cleaning, grubbing and stripping shall not be measured or paid as a separate item, but shall be included as part of the Lump Sum Cost.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.01 CLEARING

A. All trees, stumps, shrubs, bushes, windfalls and other vegetation (except such trees and vegetation as may be indicated or directed by the ENGINEER to be left standing) shall be cut off to within six inches of the ground surface and shall be removed from the construction limits. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by such means as the circumstances require.

3.02 GRUBBING

A. All stumps, roots, debris, deleterious and other organic or metallic materials not suitable for foundations shall be removed completely from the construction limits, borrow areas and soil stockpile areas. Unless otherwise permitted by the ENGINEER, stumps shall be removed completely. If any stumps are permitted to remain, they shall be cut off not more than six inches above the ground.

3.03 STRIPPING

A. Soil material containing sod, grass, or other vegetation and topsoil shall be removed to a minimum depth of six (6) inches from all areas to receive fill, from the area within lines 5 feet outside all foundation walls, over all trenches, and from beneath pavement and curb and gutter areas. The stripped material shall be deposited in such locations as are acceptable to the ENGINEER. Topsoil shall be placed over designated areas to be landscaped, and over all trench areas (outside of paved areas).

B. All areas to be reseeded will have a minimum of 3 inches of topsoil.

3.04 DISPOSAL

A. No open burning of combustible materials will be allowed.

B. All trees, timber, stumps, roots, debris, shrubs, bushes, and other vegetation removed during the clearing and grubbing operations shall be removed from the project site and disposed of by CONTRACTOR subject to specific regulations imposed by laws and ordinances and in a manner that will not create a public nuisance nor result in unsightly conditions. CONTRACTOR shall assume full responsibility for acceptable disposition of the material as well as for any damages resulting from his disposal operations.

- END OF SECTION -

SECTION 02140

DEWATERING

PART 1 - GENERAL

1.01 DESCRIPTION

A. SCOPE

The section provides specifications for dewatering systems and appurtenances to be used during construction. During excavations or construction of pumping stations, sewer pipelines, standby power generations or other projects sites, dewatering will be needed. The groundwater may also be encountered in the project site.

B. TYPE

This specification covers the use of site sump or trench pumping, well pointing, vertical sand drains, and deep well drainage systems.

1.02 QUALITY ASSURANCE

Before dewatering is commenced, the CONTRACTOR shall obtain the acceptance of the OWNER and ENGINEER for the method, installation and details of the dewatering system he proposes to use. To that end, the CONTRACTOR shall submit to the OWNER and ENGINEER plans setting forth the details of his proposed dewatering systems. The dewatering system plans shall be in sufficient detail to indicate sizes of pumps, piping, appurtenances, ultimate disposal point for water and to permit the OWNER and ENGINEER to judge the overall completeness and effectiveness of the proposed system.

The control of surface water and groundwater shall be such that softening of the bottom of excavations, or formation of "quick" conditions or "boils," does not occur. Dewatering systems shall be designed and operated so as to prevent removal of the natural soils.

The CONTRACTOR shall select the particular method of dewatering to be employed.

1.03 MEASUREMENT AND PAYMENT

Dewatering shall not be measured or paid as a separate item, but shall be included as part of the Lump Sum Cost.

PART 2 - METHODS

2.01 GENERAL

The CONTRACTOR shall furnish, install, operate and maintain all machinery, appliances, and equipment to maintain all excavations free from water during construction, and shall dewater and dispose of the water so as not to cause injury to public or private property, or to cause a nuisance or menace to the public.

The dewatering system shall be installed and operated so that the groundwater level outside the excavation is not reduced to the extent which would cause damage or endanger adjacent structures.

The static water level shall be drawn down below the bottom of the excavation to maintain the undisturbed state of the foundation soils and to facilitate in proper construction methods.

2.02 SUMP PUMPING

Sumps shall be at the low point of excavation. Excavation shall be graded to drain to the sumps.

2.03 VERTICAL SAND DRAINS

Vertical sand drains shall be installed with minimum disturbance to in situ material.

PART 3 - EXECUTION

3.01 GENERAL

One hundred percent standby pumping capacity shall be available on site at all times and shall be connected to the dewatering system piping to permit immediate use. In addition, standby ancillary equipment and appurtenances for all ordinary emergencies, and competent workmen for operation and maintenance of all dewatering equipment shall be on site at all times. Standby equipment shall include emergency power generation and automatic switchover to the emergency generator when normal power fails.

Dewatering systems shall not be shut down between shifts, on holidays, on weekends, or during work stoppages.

The CONTRACTOR shall control surface water to prevent entry into excavations.

At each excavation a sufficient number of temporary observation wells shall be available to continuously check the groundwater level shall be provided.

3.02 RELEASE OF SURFACE WATER AND GROUNDWATER

The release of surface water and/or groundwater shall be performed in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted backfill, and prevent flotation or movement of structures, pipelines and sewers. Clean water shall be disposed of by piping towards the Great Salt Lake, and released at such locations, and in such a manner, that no disturbances are created on any roads or parking lots, paved or unpaved, either by water, or by the hoses or pipes used to carry water. All released sewage shall be captured, pumped into pumper trucks, and carried to the existing wastewater containment lagoons.

- END OF SECTION -

SECTION 02221

EXCAVATION AND BACKFILL FOR BURIED PIPELINES

PART 1 GENERAL

1.01 DESCRIPTION

A. This item shall consist of excavating pipeline trenches, digging insertion pits to the grades indicated on the drawings or as directed by the ENGINEER in the field, and the backfilling of all trenches. Excavation shall include the removal of all materials of whatever nature encountered to the depths shown on the Drawings, or as modified in the field by the ENGINEER. The Contracting Officer should be notified in writing if it becomes necessary to remove rock or hard, unstable, or otherwise unsatisfactory material to a depth greater than indicated during excavation.

1.02 RELATED WORK

A. Related work specified in other sections:

Section 01440 - Quality Control & Materials Testing
Section 01500 - Temporary Construction Utilities and Environmental Controls
Section 02222 - Excavation and Backfill for Structures
Section 15067 - High-Density Polyethylene Pipe

1.03 REFERENCES

A. The latest edition of the following publications form a part of this specification to the extent referred. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 88-	Particle Size Analysis of Soils
AASHTO T 180-	Moisture-Density Relations of Soils Using a 10-lb. (4.54 kg) Hammer and an 18-in (457 mm) Drop
AASHTO T 191-	Density of Soil In-Place by the Sand-Cone Method
AASHTO T 205-	Density of Soil In-Place by the Rubber-Balloon Method
AASHTO T 238-	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
AASHTO T 239-	Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 422- Particle-Size Analysis of Soils
ASTM D 698- Test Method of Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb. (2.5-kg) Rammer and 12-in. (305-mm) Drop
ASTM D 1556- Density of Soil in Place by the Sand-Cone method
ASTM D 1557- Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop
ASTM D 2487- Classification of Soils for Engineering Purposes
ASTM D 2922- Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017- Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

B. The 2002 Edition of the American Public Works Association (APWA) and Associated General Contractors of America Standard Plans and Standard Specifications.

1.04 SUBMITTALS

A. If requested by the ENGINEER, CONTRACTOR shall furnish certified test results from an approved laboratory showing that the material and imported backfill material conforms to the Specification requirements. This test result will be paid for by OWNER.

B. The following shall be submitted in accordance with Section 01300 Contractor Submittals:

1. Copies of Field Density Test reports shall be submitted to the ENGINEER or OWNER's representative at the beginning of each work day for the previous day's testing of subgrades, embankments and backfill materials.

2. Copies of all laboratory test reports shall be submitted to the ENGINEER or OWNER's representative within 24 hours of the completion of the test.

1.05 SITE CONDITIONS

A. Weather Softened Subgrade: CONTRACTOR shall remove and replace at no additional cost to OWNER, soft subgrade materials resulting from adverse weather conditions.

B. Protection of Graded Areas: CONTRACTOR shall protect all graded areas from traffic and erosion and shall keep these areas free of trash and debris. Work required to repair and reestablish grades in settled, eroded, and rutted areas shall be completed to specified tolerances at CONTRACTOR's expense.

C. Reconditioning Compacted Areas: All areas compacted (to meet required specifications) that become disturbed by subsequent construction operations or weather conditions shall be scarified, moisture conditioned and re-compacted to the required density prior to further construction.

1.06 MEASUREMENT AND PAYMENT

A. Excavation and Backfill for Buried Pipelines and other project sites shall not be measured or paid as a separate item, but shall be included as part of the Lump Sum Costs.

PART 2 PRODUCTS

2.01 PIPE BACKFILL

A. Pipe Zone Backfill shall consist of the bedding material schedule shown in Table 2.01 (A) below. All backfill material shall be free of frozen material, organic material, and debris.

Table 2.01 (A)
Backfill Materials

SIEVE SIZE	PERCENT PASSING		
	FOUNDATION MATERIAL	PIPE ZONE MATERIAL	FINAL BACKFILL MATERIAL
2 inch	100	---	Native material which contains no sod, vegetation, rocks larger than 6" in diameter, asphalt or concrete chunks, etc.
3/4 inch	0 – 50	100	
No. 4	0 – 10	40 - 70	
No. 50	0 – 5	20 - 50	
No. 200	0 – 3	5 - 30	

B. Trench backfill above the pipe zone shall be Import Granular Backfill Borrow meeting the requirements of APWA Section 02055 for Granular Backfill Borrow. No backfill material in the remainder of the trench shall have rocks larger than 2-inches in diameter. All backfill material shall be free of frozen material, organic material and debris.

PART 3 EXECUTIONS

3.01 EXCAVATION

A. Excavation shall be performed to the lines and grades indicated. Excavated material not required or not satisfactory for backfill shall be removed from the site.

B. Excavation shall be performed for ledge rock, boulders, and other unyielding material to a depth at least 6 inches below the bottom of the pipe, conduit and appurtenances unless otherwise indicated or specified. Blasting will not be permitted. Over excavate soft, weak, or wet excavations as indicated. Use bedding material, gravel and sand placed in 6 inch maximum lifts to refill over depths to the proper grade. At the Contractor's option, the excavations may be cut to an over depth of not less than 4 inches and refilled to required grade as specified. Grade bottom of trenches accurately to provide uniform bearing and support for each section of pipe, conduit, tank etc. structure on undisturbed soil, or bedding material as indicated or specified at every point along its entire length except for portions where it is necessary to excavate for bell holes and for making proper joints. Dig bell holes and depressions for joints after trench has been graded. Dimension of bell holes shall be only ½ inch greater than length, width, and depth of bell as required for properly making the particular type of joint to ensure that the bell does not bear on the bottom of the excavation. Trench dimensions shall be as indicated or specified.

3.02 SAFETY

A. Excavations shall be supported in a safe manner in accordance with applicable State safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29 CFR1926). The CONTRACTOR is responsible for assessing safety needs to meet such requirements, arranging for proper equipment and/or construction methods, and maintaining such equipment, methods and construction practices so as to fully comply with all such safety requirements.

B. The CONTRACTOR is responsible for assessing safety needs related to confined space entry, as defined by OSHA. The CONTRACTOR shall meet all such requirements, arranging for proper equipment and/or construction methods, and maintaining such equipment, methods and construction practices so as to fully comply with all confined space safety requirements.

3.03 TRENCH WIDTH

A. Trench bottoms shall have a minimum width equal to the outside diameter of the pipe plus 12-inches or as detailed on the drawings.

B. The width of the trench shall permit the pipe to be laid and jointed properly, and the backfill to be placed as specified. When required, trenches shall have extra width to permit the placing of timber supports, sheeting, and bracing, and the handling of special units as necessary.

3.04 TRENCH PREPARATION

A. Trenches shall be excavated along the alignment and grade as shown in the drawings. The trench walls shall be braced to ensure safety. Pipe shall be laid in a dry, water free trench.

B. The pipe bedding shall be shall be given a final trim using a string line, laser, or another method approved by the ENGINEER for establishing grade, such that each pipe section when first laid will be continually in contact with the ground along the extreme bottom of the pipe. Bell holes shall be provided at each joint to permit the jointing to be made properly. The trench grade shall permit the pipe spigot to be accurately centered in the preceding pipe joint, without lifting the pipe above the grade, and without exceeding the permissible joint deflection.

C. Pipe shall be bedded a minimum of 6-inches with sand or gravel meeting the bedding requirements. In unstable ground areas, where the native soils are unsuitable for the type of pipe being installed or as directed by the ENGINEER, an additional 12-inch of free draining gravel shall be required.

3.05 REMOVAL OF WATER

A. CONTRACTOR shall provide and maintain at all times means and devices with which to remove promptly and to properly dispose of all water entering the trench excavation. Trenching shall remain free of water at all times during construction to the best efforts of the CONTRACTOR.

B. CONTRACTOR shall obtain all necessary permits required for discharge of water.

C. Water shall be disposed of without damage to adjacent property or without being a menace to public health and convenience. No water shall be drained into work built or under construction without prior consent of the ENGINEER.

D. Dewatering shall be accomplished by well points, sumping, or any other acceptable method which will ensure a dewatered trench. Any dewatering method shall be subject to the approval of the ENGINEER.

3.06 PIPELINE TRENCH BACKFILL

A. Pipeline trenches shall be backfilled to 12-inches above the top of the pipe with Import Select Fill material as specified in paragraph 2.01. Such material shall be compacted to 90% minimum Modified Proctor density (ASTM D-1557) in six inch maximum lifts.

B. Backfill of the remainder of pipe trenches shall be completed upon installation and approval of pipe backfill material. All backfill above the protected pipe shall be placed and compacted. Compaction shall be performed by mechanical tamping in 12-inch maximum lifts. All backfill material shall be free of frozen material, organic material, and debris.

3.07 MAINTENANCE OF BACKFILL

A. All backfill material shall be maintained in a satisfactory condition. All places showing signs of settlement shall be filled and maintained during the life of the contract and a period of one year following the day of final acceptance of all work performed under the contract.

B. When CONTRACTOR is notified by the ENGINEER or OWNER that any backfill is hazardous, CONTRACTOR shall correct such hazardous condition as soon as possible.

C. Any utility, road and/or parking surfacing damage by settlement shall be repair by CONTRACTOR. The CONTRACTOR shall be responsible for the cost to OWNER of all claims for damage filed with the Court, actions brought against the said OWNER for, and on account of, such damage.

3.09 DISPOSAL OF EXCAVATED MATERIAL

A. All excavated material shall be disposed to prevent detrimental circumstances.

3.10 FINISH GRADING, CLEANUP

B. CONTRACTOR shall grade the trench lines so they become aesthetically pleasing.

C. All tools, equipment and temporary structures shall be removed. All excess dirt and rubbish shall be removed from the site by CONTRACTOR.

D. CONTRACTOR shall restore the site to the original condition, including but not limited to final trench grade, native vegetation and restoration of affected public and private facilities whether in the public right of way or on private property. Any exception to this requirement shall be obtained in writing from the ENGINEER.

3.11 COMPACTION TESTS

A. Compaction Quality Control Testing shall be the provided and paid for by the OWNER in accordance with Section 01440. A minimum 24 hours (or as otherwise specified) notice must be given to schedule all tests.

B. It shall be the responsibility of the CONTRACTOR to accomplish the specified compaction for backfill, fill, and other earthwork.

C. It shall be the responsibility of the CONTRACTOR to control operations by performing any additional tests necessary to verify and confirm that CONTRACTOR is in compliance with specifications with respect to compaction, control, and testing.

1. Testing of Backfill Materials

a. Characteristics of backfill materials shall be determined in accordance with the requirements of Section 01440.

b. The CONTRACTOR shall demonstrate the adequacy of compaction equipment and procedures before exceeding 200 linear feet of trench backfill.

c. No additional earthwork shall be performed until specified degree of compaction of on previous earthwork is achieved.

d. If compaction fails to meet specifications, the CONTRACTOR shall remove and replace the backfill at proper density or shall bring the density up to specified level by other means acceptable to the ENGINEER. Subsequent tests required to confirm and verify that the reconstructed backfill has been brought up to specified density shall be paid by the CONTRACTOR. The CONTRACTOR's confirmation tests shall be performed in a manner acceptable to the ENGINEER. Frequency of confirmation tests for remedial work shall be double that amount specified for initial confirmation tests.

2. Field Density Tests

a. Tests shall be performed in sufficient numbers to meet the requirements of Section 01440 and to ensure that the specified density is being obtained.

b. Quality Assurance Confirmation tests shall be at the discretion of and be paid by the OWNER.

D. Field density tests shall be made in accordance with ASTM D-1557 (See Section 01440).

E. The cost of field density tests shall be included in the Lump Sum Costs.

PART 4 SHORING AND SHEETING

4.01 EXECUTION

A. Shore and sheet excavations are to prevent injury to persons and damage to structures. Arrange shoring and sheeting to preclude injurious caving during removal. Obtain approval from the Contracting Officer prior to removing shoring, sheeting, or bracing in excavations adjacent to on-grade slabs, foundations, or other structural elements.

- END OF SECTION -

SECTION 02222

EXCAVATION AND BACKFILL FOR STRUCTURES

PART 1 GENERAL

1.01 DESCRIPTION

A. This section covers excavating, backfilling and compacting for structures as directed by ENGINEER.

1.02 REFERENCES

A. The latest edition of the following publications form a part of these specifications to the extent referred. The publications are referred to in the text by basic designation only.

AASHTO T 88-	Particle Size Analysis of Soils
AASHTO T 180-	Moisture-Density Relations of Soils Using a 10-lb. (4.54 kg) Rammer and an 18-in (457 mm) Drop
AASHTO T 191-	Density of Soil In-Place by the Sand-Cone Method
AASHTO T 205-	Density of Soil In-Place by the Rubber-Balloon Method
AASHTO T 238-	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
AASHTO T 239-	Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 422-	Particle-Size Analysis of Soils
ASTM D 698-	Test Method of Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb. (2.5-kg) Rammer and 12-in. (305-mm) Drop
ASTM D 1556-	Density of Soil in Place by the Sand-Cone method
ASTM D 1557-	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop
ASTM D 2487-	Classification of Soils for ENGINEERing Purposes
ASTM D 2922-	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017-	Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

1.03 SUBMITTALS

A. If requested by the ENGINEER, the CONTRACTOR shall furnish a certified test result from an approved laboratory showing that the free draining gravel material and granular backfill material conforms to the Specification requirements of the Owner.

B. The following shall be submitted:

1. Copies of Field Density Test reports shall be submitted to the ENGINEER at the beginning of each work day for the previous day's testing of subgrades, gravel and structural fill.

1.04 MEASUREMENT AND PAYMENT

C. Excavation and Backfill for Structures shall not be measured or paid as a separate item, but shall be included as part of the Lump Sum Cost.

PART 2 PRODUCTS

2.01 WALL BACKFILL

A. Wall backfill material shall be free from frozen lumps, rocks larger than 4 inches in the largest dimension, roots, trash, lumber and organic material.

2.02 STRUCTURAL FILL

A. Structural fill material placed below foundations shall be non-expansive granular soil with less than 15 percent passing the No. 200 sieve, a maximum size of not greater than 2-inches, and a liquid limit of less than 30 percent.

B. Fill to support the floor slab shall be well-graded, structural fill consisting of non-expansive granular soil with less than 15 percent passing the No. 200 sieve and a maximum size of not greater than 2-inches. A 6-inch thick layer of free draining gravel (less than 5 percent passing the No. 200 sieve and a maximum size of not greater than 2-inches) shall be placed below the floor slab for the Pump House.

PART 3 EXECUTION

3.01 EXCAVATION

A. Excavation shall be performed to the lines and grades indicated. Excavated material not required or not satisfactory for backfill shall be removed from the site.

3.02 BACKFILL

A. Backfill and structural fill material shall not be placed against concrete structure that have not been properly cured

B. Backfill and structural fill material shall be placed in no more than 6-inch loose lifts.

C. Structural fill placed beneath footings and the floor slab shall be placed and compacted to at least 95 percent of maximum dry density at a moisture content within 2 percent of optimum moisture content in accordance with ASTM D-1557.

D. All other backfill material shall be placed and compacted to at least 90 percent of maximum dry density at a moisture content within 2 percent of optimum moisture content in accordance with ASTM D-1557.

E. Where the moisture content is not suitable and/or sufficient compaction has not been obtained, the fill shall be reconditioned to an approved moisture content and recompacted to the minimum required compaction prior to placing any additional fill material.

F. Unless otherwise specified, the developed/contractor shall be responsible for arranging for the placing and compacting of approved fill material in accordance with these Specifications. If the Testing Agency should determine that the CONTRACTOR is failing to meet the minimum requirements, the CONTRACTOR shall stop operations and make adjustments as necessary to produce a satisfactorily compacted.

G. Sufficient personnel, equipment, sumps or other means should be provided to maintain the site in an acceptable dry condition for the duration of this contract.

H. Excavations shall be so braced and supported as needed to prevent the ground, adjacent to the excavation, from sliding or settling.

3.03 REMOVAL OF WATER

A. The CONTRACTOR shall provide and maintain at all times ample means and devices with which to remove promptly and to properly dispose of all water entering the trench excavation.

B. Water shall be disposed of in a suitable manner without damaging the adjacent property or without being a menace to public health and convenience. No water shall be drained into work built or under construction without prior consent of the ENGINEER.

C. Dewatering shall be accomplished by well points, sumping, or any other acceptable method which will insure a dewatered trench. Any dewatering method shall be subject to the approval of the ENGINEER.

D. CONTRACTOR shall obtain all necessary permits required for discharge of water.

3.04 FINISHED GRADE

A. The finished subgrade and grade of the fill shall not vary more than 0.05 feet from the established grades and cross-sections shown on the Drawings.

3.05 COMPACTION TESTS

A. Compaction Quality Control Testing shall be provided and paid for by the CONTRACTOR. A minimum of 24 hours (or as otherwise specified) notice must be given to schedule all tests.

B. It shall be the responsibility of the CONTRACTOR to accomplish the specified compaction for backfill, structural fill, and other earthwork. It shall be the responsibility of the CONTRACTOR to control his operations by performing any additional tests necessary to verify and confirm that CONTRACTOR has complied, and is complying at all times, with the requirements of these Specifications concerning compaction, control, and testing.

1. Testing of Backfill Materials

    a. Characteristics of backfill materials shall be determined.

    b. The CONTRACTOR shall demonstrate the adequacy of compaction equipment and procedures before exceeding any of the following amounts of earthwork quantities:

(1) One (1) test per 1.5 feet of backfill thickness placed per structure.

c. Until the specified degree of compaction on the previous earthwork is achieved, no additional earthwork of the same kind shall be performed.

d. After satisfactory conclusion of the initial compaction demonstration and at any time during construction, earthwork which does not comply with the specified degree of compaction shall not exceed the previously specified quantities.

e. Periodic compliance tests may be made by the ENGINEER to verify that compaction is meeting the requirements previously specified at no cost to the CONTRACTOR. The ENGINEER may require retesting of backfill (by CONTRACTOR's Testing Agency) that has settled from water penetration in the trench. CONTRACTOR shall remove the overburden above the level at which the ENGINEER wishes to test and shall backfill and re-compact the excavation after the test is complete at no additional cost.

f. If compaction fails to meet the specified requirements, the CONTRACTOR shall remove and replace the backfill at proper density or shall bring the density up to specified level by other means acceptable to the ENGINEER. Subsequent tests required to confirm and verify that the reconstructed backfill has been brought up to specified density shall be paid by the CONTRACTOR. The CONTRACTOR's confirmation tests shall be performed in a manner acceptable to the ENGINEER. Frequency of confirmation tests for remedial work shall be double the amount specified for initial confirmation tests.

C. Field density tests shall be made in accordance with ASTM D-1557.

- END OF SECTION -

SECTION 02278

STRUCTURAL FILL

PART 1 GENERAL

1.01 DESCRIPTION

A. Structural fill will be required to provide a more stable base for various project components such as manhole, wet well, sewer pipe, etc.

1.02 REFERENCES

A. The latest edition of the following publication forms a part of this specification to the extent referenced. The publication is referred to in the text by basic designation only.

AASHTO T 88- Particle Size Analysis of Soils
AASHTO T 180- Moisture-Density Relations of Soils Using a 10-lb. (4.54 kg) Rammer and an 18-in (457 mm) Drop
AASHTO T 191-Density of Soil In-Place by the Sand-Cone Method
AASHTO T 205-Density of Soil In-Place by the Rubber-Balloon Method
AASHTO T 238-Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
AASHTO T 239-Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 422-Particle-Size Analysis of Soils
ASTM D 698- Test Method of Moisture-Density Relations of Soils and Soil-Agregate Mixtures Using 5.5 lb. (2.5-kg) Rammer and 12-in. (305-mm) Drop
ASTM D 1556-Density of Soil in Place by the Sand-Cone method
ASTM D 1557-Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop
ASTM D 2487-Classification of Soils for Engineering Purposes
ASTM D 2922-Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017-Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

B. The 1997 Edition of the American Public Works Association (APWA) and Associated General Contractors of America Standard Plans and Standard Specifications.

1.03 SUBMITTALS

A. CONTRACTOR shall submit the result of laboratory testing of the fill material proposed for use as Structural Fill to the ENGINEER for review.

PART 2 PRODUCTS

2.01 MATERIALS

A. Structural backfill shall consist of hard, durable particles of stone or gravel, screened or crushed to the required size and grading as listed below. The material shall be free from vegetation or clay and shall conform to the following grading:

Sieve Size	Percent Passing by Weight
2-inch	100
1-1/2-inch	95-100
¾ - inch	50-100
3/8 – inch	15-55
#4	0-25
#8	0-5
#200	0-3

PART 3 EXECUTION

3.01 STRUCTURAL FILL MATERIAL PLACEMENT

A. The structural fill shall be placed in lifts not exceeding 8 inches in loose thickness and compacted to a minimum of 95 percent Modified Standard Proctor Density as determined accordance with ASTM D698.

B. Unsuitable wetland bottom material shall be removed and replaced with structural fill material.

3.02 FIELD QUALITY CONTROL

A. CONTRACTOR shall be responsible for directing proper placement of all structural fill materials.

B. Fill shall not be placed in the presence of ice, snow or frost.

--END OF SECTION--

SECTION 02316

SLIPLINING OF EXISTING SEWER

PART 1 GENERAL

1.01 SUMMARY

A. This section describes the rehabilitation of sewers using slip lining techniques. This section covers the installation of a new, smaller diameter pipe inside of an existing sewer pipe that will be abandoned.

1.02 DEFINITION

A. Sliplining: the insertion of pipes retaining their circular cross section inside an existing pipeline, with the outside diameter of the new pipeline being smaller than the inside diameter of the existing pipeline.

B. Sliplining pits: The excavation (or manhole) from which smaller diameter pipe is to be inserted into a larger diameter pipe is pushed and/or pulled as appropriate.

1.03 RELATED WORK

A. Related work in other sections includes but is not limited to:

Section 02221 Excavation and Backfill for Buried Pipelines
Section 02222 Excavation and Backfill for Structures

PART 2 PRODUCT STORAGE

A. Pipes must be stored on flat level ground or the storage base must be made level to ensure pipes are stacked level and vertical. Pipes must be kept securely anchored to prevent movement.

B. HDPE pipes must be stored away from contact with chemicals or ground contaminated with chemicals.

C. Care must be taken to prevent scoring and scratching of HDPE pipes.

D. Rubber rings for pipe joints must be stored in a cool area, and away from direct sunlight. They must be protected to ensure that there is no contact with petroleum products. Styrene butadiene rubber rings must also be stored away from sources of ozone such as fluorescent lights and electric motors.

PART 3 EXECUTION

3.01 INSTALLATION

A. Excavation for sliplining pits shall be constructed and spaced as shown on the Drawings and as required for the proper installation of the pipe.

B. Where cleaning of the existing pipeline is required for the sliplining technique being used, the cleaning method must be approved by the ENGINEER and be appropriate for the condition of the pipeline, the type of foreign material inside the pipeline and the length of the pipeline. Cleaning must be carried out from the downstream end. The cleaning method must minimize damage to the existing pipeline. The CONTRACTOR shall remove all internal debris out of the abandoned water line that will interfere with the installation of the HDPE pipe. The OWNER shall also provide a dump site for all debris removed from the water line during the cleaning operation.

C. It shall be the responsibility of the CONTRACTOR to clear the abandoned line of obstructions such as solids and roots that will prevent the insertion of the HDPE pipe. The CONTRACTOR may pull a "pig" through the existing pipeline, and/or flush the line with water to verify that there are no obstructions or collapses which would prevent the installation of the HDPE pipe. If pre-installation work finds an obstruction such as a dropped joint, or a collapse that will prevent the sliplining process, and it cannot removed by conventional pipeline cleaning equipment, then the CONTRACTOR shall make a point repair excavation to uncover and remove or repair the obstruction. All removed material and the flushing water shall be disposed of in a sanitary manner, and may be discharged at the Wastewater Containment Lagoons after written permission from the OWNER.

D. CONTRACTOR shall maintain sewer service of site according to Section 01501.

E. The CONTRACTOR shall be responsible for confirming the locations of all branch service connections prior to installing the HDPE pipe.

F. Sliplining Procedure

1. The CONTRACTOR shall pull the HDPE pipe through the abandoned PVC pipes, ensuring all HDPE pipe joint welds have complete integrity and are welded according to manufacturer's specifications.

2. After the HDPE pipe has been successfully sliplined as indicated, the CONTRACTOR shall tie the HDPE line to the existing service as shown on the Drawings.

G. After the HDPE pipe has been installed, the CONTRACTOR shall install air release stations and make service connections as shown on the Drawings.

H. Grouting

1. The annulus of the existing pipe and the inserted pipe must be filled with grout at the access points (insertion pits) as shown in the plans. The method, materials and equipment for grouting must be approved by the ENGINEER.

PART 4 MEASUREMENT AND PAYMENT

A. Sliplining of existing sewer shall not be measured or paid as a separate item, but shall be included as part of the Lump Sum Cost.

- END OF SECTION -

SECTION 02500

REMOVAL AND REPLACEMENT OF SURFACE IMPROVEMENTS

PART 1 GENERAL

1.01 SUMMARY

A. This section presents the restoration, removal and replacement of surface improvements as established in this specification, as directed by the ENGINEER.

1.02 RELATED SECTIONS

A. Related work specified in other sections includes but is not limited to:

Section 02221 - Excavation and Backfill for Buried Pipelines
Section 02745 - Hot-Mix Asphalt Concrete Paving

1.03 REFERENCES

A. The most recent edition of the Utah Public Works General Conditions and Standard Specifications for Construction.

B. The most recent edition of the American Public Works Association (APWA) and Associated General Contractors of America Standard Plans and Standard Specifications.

C. The following are also references applicable to this section.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1557-	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop
ASTM D 2487-	Classification of Soils for Engineering Purposes
ASTM D 2922-	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017-	Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

1.04 DEFINITIONS

A. Class A Road Repair: This term shall consist of construction of a bituminous surface course, aggregate base and bituminous prime and tack coats as defined in Section 02745 - Hot-Mix Concrete Asphalt Paving.

B. Class B Road Repair: This term shall consist of construction of a gravel road surface.

C. Site Drainage: This section pertains to the restoration of storm water naturally draining across or falling on the project site and irrigation water.

1.05 SUBMITTALS

A. Prior to placement of asphalt concrete, the CONTRACTOR shall submit to the ENGINEER for review and acceptance, full details, including design and calculations for the asphalt concrete mix he proposes to use.

B. Laboratory mix design for proposed seal coat application.

C. Quality assurance tests for asphalt and aggregate material sources.

D. Copies of weight and delivery tickets shall be submitted during progress of the work.

E. Untreated Base Course - 3/4" gradation.

1.06 MEASUREMENT AND PAYMENT

A. Removal and Replacement of Surface Improvements shall not be measured or paid as a separate item, but shall be included as part of the various items to which it relates and according to Section 1025-Measurement and Payment.

PART 2 PRODUCTS

2.01 BITUMINOUS MATERIAL

A. The bituminous material shall be as specified in Section 02745, Hot-Mix Asphalt Concrete Paving.

B. Mix design testing shall be responsibility of the CONTRACTOR and shall be paid by the CONTRACTOR. Field sampling and testing shall be the responsibility of the OWNER.

2.02 TACK COAT

A. Tack coat material shall conform to all requirements of APWA Section 02709.

2.03 UNTREATED BASE COURSE

A. Untreated Base Course (UBC) shall be 3/4".

2.04 RESTORATION OF DISTURBED SURFACE

A. CONTRACTOR shall grade and smooth all surfaces which were disturbed as a result of the construction or access to construction sites. Areas surrounded by bare ground may be left bare. Areas of wetlands or areas in which vegetation was disturbed shall be leveled, smoothed, and raked to a depth of 1" and native grass seed sown, as recommended for successful germination by the vendor of the seed.

PART 3 EXECUTION

3.01 CLASS A ROAD REPAIR

A. Class A Roads shall be constructed in accordance with Section 02745 Hot-Mix Asphalt Concrete Paving. Asphalt pavement replacement shall be of the same thickness as the adjacent pavement (3-inch minimum) and shall match as nearly as possible the adjacent pavement in texture, unless otherwise indicated.

B. The CONTRACTOR shall install temporary asphalt pavement or the first course of permanent pavement replacement immediately following backfilling and compaction of trenches that have been cut through existing pavement. Except as otherwise provided, this preliminary pavement shall be maintained in a safe and reasonably smooth condition until required permanent pavement is installed. Temporary paving removed shall be hauled from the jobsite and disposed of at the CONTRACTOR's expense.

C. Where a longitudinal trench is partly in pavement, the pavement shall be replaced to the original pavement edge, on a straight line, parallel to the center line of the roadway.

D. Where no part of a longitudinal trench is in the pavement, surfacing replacement will only be required where existing surfacing materials have been removed.

E. Existing asphalt pavements to be removed for trenches or other underground construction or repair shall be cut (a minimum of one foot outside the edge of the proposed excavation line) by a wheel cutter, clay spade, asphalt grinder, or other device capable of making a neat, reasonably straight and smooth cut without

damaging adjacent pavement that is not to be removed. The cutting device operation shall be subject to the approval of the ENGINEER.

F. The existing pavement shall be cut and trimmed after placement of required UBC and just prior to placement of asphalt concrete for pavement replacement, and the trimmed edges shall be painted with a light coating of asphalt cement or emulsified asphalt immediately prior to constructing the new abutting asphalt pavements. No extra payment will be provided for these items, and all costs incurred in performing this work shall be incidental to pipe laying or pavement replacement.

G. Any existing base, surfacing, or pavement shall be thoroughly cleaned immediately prior to receiving the plant-mixed surfacing. Where existing pavement is being widened or extended, it shall be cut to a straight vertical face prior to the paving operations and treated with asphalt paint binder.

H. The ENGINEER shall be notified of the source of the asphalt to be used. The ENGINEER will specify the temperature limits for the asphalt cement, aggregate mix and lay-down.

3.02 ASPHALT WORK BETWEEN OCTOBER 15 AND APRIL 15

A. Asphalt cuts not repaired prior to October 15 shall be repaired using a temporary patch, unless written approval is provided from the OWNER or ENGINEER as specified above. Temporary patches may consist of either asphalt cold patch or concrete. Temporary patches shall be completely removed after April 15 and repaired in accordance with these specifications at no additional expense to the Owner.

3.03 CLASS B ROAD REPAIR

A. No aggregate base course material shall be placed on the subgrade until it has been checked and accepted by the ENGINEER.

B. Prior to excavation on graveled roads, the graveled surface shall be graded off the road and away to the downhill side of the trench, far enough from the trench that the subsurface materials will not pollute the salvaged gravel material. After completion of the pipeline work and backfill operations, the road shall be graded smooth and the salvaged gravel shall be mixed with additional untreated base course material to allow for a uniform 8-inch thick layer over the entire trench surface, graded smooth, and compacted to 95% minimum modified proctor density (ASTM D-1557).

3.04 CONCRETE WORK

A. Concrete work shall meet the specifications for installation as noted in APWA Section 02770, Concrete Driveway, Sidewalk, Curb and Gutter.

B. All flat work in streets tying into existing flatwork shall be doweled into the existing concrete. Dowels to be spaced at 12" O.C. and be No. 5 x 14" for slabs up to 8 inches in thickness and No. 8 x 18" for slabs over 8 inches.

- END OF SECTION -

SECTION 02745

HOT-MIX ASPHALT CONCRETE PAVING

PART 1 GENERAL

1.01 SUMMARY

A. This section addresses the requirements for installing hot-mix and lot-laid asphalt concrete.

1.02 RELATED SECTIONS

A. Related work specified in other sections includes but not limited to:

Section 02705 - Asphalt Concrete (APWA)
Section 02708 - Prime Coat (APWA)
Section 02709 - Tack Coat (APWA)

1.03 REFERENCES

A. The 1991 Edition of the Utah Public Works General Conditions and Standard Specifications for Construction.

B. The 1997 Edition of the American Public Works Association (APWA) and Associated General Contractors of America Standard Plans and Standard Specifications.

C. The following are also references applicable to this section:

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T230: Standard Method of Test for Determining Degree of Pavement Compaction of Bituminous Aggregate Mixtures.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1559: Standard Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.

ASTM D 2041: Standard Test Method for Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures. (Rice Test Method)

ASTM D 2950:	Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Method.
ASTM D 3665:	Standard Practice for Random Sampling of Construction Methods.

1.04 SUBMITTALS

A. Laboratory mix design for proposed hot-mix asphalt concrete paving.

B. Means and methods for removal, reprocessing, and placement of existing asphalt surfaces as base course material.

C. Laboratory mix design for proposed prime coat application.

D. Laboratory mix design for proposed tack coat application.

E. Quality assurance tests for asphalt and aggregate material sources.

F. Copies of batch delivery tickets shall be submitted during progress of the work, and shall show the following information:

Name of production facility; Serial number of ticket
Date and truck number; Name of CONTRACTOR
Job name and location; Weight of asphalt concrete
Loading temperature; Signature or initial of plant representative
Type and grade of asphalt cement; Type and grade of aggregate
Applicable mix design method; Separate weights of aggregate and asphalt

G. Submit type and number of rollers required for compacting asphalt concrete.

H. The maximum theoretical specific gravity (ASTM 2041) and rut and fatigue testing using the asphalt analyzer will be submitted at the expense of the Contractor.

1.05 SITE CONDITIONS

A. Pave only when air and roadbed temperatures in the shade are greater than 50 deg. F. The temperature restrictions may be waived only upon written authorization from ENGINEER.

B. Do not pave during rain or unsuitable weather or when surface is wet.

1.06 ACCEPTANCE

A. Acceptance of hot-mix asphalt concrete paving is based upon minimum density, minimum thickness, smoothness, and surface appearance.

1.07 MEASUREMENT AND PAYMENT

A. Hot Mix Asphalt of Surface Improvements shall not be measured or paid as a separate item, but shall be included as part of the Lump Sum Cost.

PART 2 PRODUCTS

2.01 BITUMINOUS MATERIAL

A. The bituminous material shall be ***AC-20*** asphalt cement (or Engineer approved).

B. The hot-mix asphalt cement design shall meet heavy traffic classification.

C. Sampling and testing shall be the responsibility of the CONTRACTOR.

2.02 PRIME COAT

A. Prime coat material shall be rapid cure cutback asphalt, and shall conform to all requirements of APWA Section 02708.

2.03 TACK COAT

A. Tack coat material shall conform to all requirements of Section 02709 of the APWA specification.

PART 3 EXECUTION

3.01 PREPARATION

A. Preparation shall conform to all requirements of Section 02745 of the APWA specifications.

B. CONTRACTOR shall map and mark all existing surface utilities within the line of work, and shall lower fixtures if pavement machine is not capable of passing over structure.

C. All asphalt and concrete surfaces within the line of work are to be removed and disposed of properly by the CONTRACTOR. The CONTRACTOR may, upon written authorization of the OWNER, use processed asphalt materials as base course material. Excess materials shall be removed and disposed by the CONTRACTOR.

D. Existing asphalt pavements and drive approach extensions to be removed shall be cut by a wheel cutter, clay spade, or other device capable of making a neat, reasonably straight and smooth cut without damaging adjacent pavement and/or concrete that is not to be removed. The cutting device operation shall be subject to the approval of the ENGINEER.

3.02 BASE COURSE

A. Base course material shall be placed in accordance with Section 02278 of these specifications.

B. Base course surfaces shall be maintained in an acceptable condition for both moisture and density until the overlying hot-mix asphalt cement materials have been placed, at no additional expense to the OWNER.

3.03 PLACEMENT OF PRIME COAT

A. Apply prime coat to all untreated base course surfaces in accordance with Section 02708 of the APWA Specifications.

3.04 PLACEMENT OF TACK COAT

A. Apply tack coat to all existing asphalt concrete or portland cement concrete surfaces preparatory to placing asphalt concrete pavement in accordance with Section 02709 of the APWA Specifications.

3.05 PLACEMENT OF HOT-MIX ASPHALT CONCRETE

A. Spreading shall be as nearly continuous as possible.

B. Placement shall also allow for line, grade, elevations, and thickness specified herein and as shown on the drawings.

C. When asphalt concrete is laid against vertical surfaces such as gutters, the face of the vertical surface shall be roughened for proper bonding, cleaned, and then painted with a light coating of asphalt cement or emulsified asphalt.

D. At terminations of new surface course, the asphalt concrete shall be feathered into the existing surface over such a distance as may be required to produce a smooth riding transition. Base course and single course construction shall be joined by vertical butt joints finished and rolled to a smooth surface.

E. Asphaltic concrete shall not be placed when frozen materials are present in the base or subbase.

F. Asphaltic concrete shall not be placed during adverse conditions, i.e., rain or when a roadway surface is wet.

G. Asphaltic concrete shall be placed between April 15 and October 15. Asphalt concrete shall not be placed after October 15 and before April 15 of the following year unless roadway surface temperatures are 50° F and rising in the shade. Approval to place the asphalt concrete after October 15 and before April 15 of the following year requires written approval from the OWNER.

H. Roadways not completed prior to October 15, and not meeting the requirements of this section, shall be repaired by placing a temporary 2-inch thick asphalt course (or other ENGINEER approved surface) over all exposed, earthen surfaces. These temporary surfaces shall be completely removed and repaired between April 15th and October 15th and in accordance with these specifications at no additional expense to the OWNER.

I. Asphalt rolling shall be in accordance with Section 02745 of the APWA Specifications. The CONTRACTOR shall establish and document a rolling pattern for obtaining densities. The test strip shall be no shorter than 300 feet. Establishment of rolling patterns are for the purpose of establishing minimum rolling patterns, and shall not release the CONTRACTOR of meeting all requirements of these specifications and drawings.

J. The target density for asphalt placement shall be 96 percent of laboratory density. If an individual test result falls below 94 percent of maximum density, the material represented by that test will be considered defective, and shall be removed and replaced by the CONTRACTOR at no additional cost to the OWNER.

K. The minimum acceptable thickness of completed roadways shall be 3 inches, as verified by core samples. Areas found to contain less than 3 inches shall be removed and replaced, or overlain with an additional 1.5-inch minimum thickness asphalt at no additional expense to the OWNER.

L. The completed finish shall be as specified in Section 02745 of the APWA Specifications.

M. CONTRACTOR shall adjust the height of all street fixtures to match final grade. Concrete collars shall be placed around all surface street fixtures (i.e. manholes, valve boxes, monuments, etc.) as shown on the Drawings.

N. CONTRACTOR shall complete all concrete collars within 2 weeks of completion of paving each roadway section.

3.06 SITE SAFETY AND TRAFFIC CONTROL

Site safety and traffic control shall be the responsibility of the CONTRACTOR.

The CONTRACTOR shall verify full compliance with all applicable local, county, state and/or federal regulations.

- END OF SECTION -

DIVISION 3

CONCRETE

SECTION 03100

CONCRETE FORMWORK

PART 1 GENERAL

1.01 SUMMARY

A. This section covers the work necessary to furnish, install and complete the concrete formwork.

1.02 MEASUREMENT AND PAYMENT

A. Concrete formwork shall not be measured or paid as a separate item, but shall be included as part of the Lump Sum Cost.

1.03 REFERENCES

A. The latest edition of the following publications form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

1. American Concrete Institute (ACI) -ACI 347R- Concrete Formwork.
2. American Hardboard Association (AHA)-AHA A135.4- Basic Hardboard.
3. Department of Commerce (DOC) -DOC PS 1- Construction and Industrial Plywood.
4. ACI 350R-89 - Environmental Engineering Concrete Structures.

1.04 DESIGN

A. Formwork shall be designed in accordance with methodology of ACI 347R for anticipated loads, lateral pressures, and stresses. Forms shall be capable of producing a surface which meets the requirements of the finish specified in Section 03300 Cast-In-Place Concrete. Forms shall be capable of withstanding the pressures resulting from placement and vibration of concrete.

1.05 SUBMITTALS

A. The following shall be submitted:

1. Drawings showing details of forming, shoring and bracing for footings, walls, and floors shall be submitted to the ENGINEER at least 3 weeks prior

to their use. Drawings showing details of formwork shall include joints, supports, studding and shoring, and sequence of form and shoring removal.

2. If requested by the ENGINEER, design analysis and calculations shall be submitted for form design and methodology used in the design. The analysis and calculations shall verify the selection of form ties, horizontal and vertical stiff-backs or braces for wall panels, forming and form openings, or any other part of forming, shoring or bracing which may be considered critical by the ENGINEER.

3. Manufacturer's data including literature describing form materials, accessories, and form releasing agents.

4. Manufacturer's recommendation on method and rate of application of form releasing agent.

B. The ENGINEER's review will not relieve the CONTRACTOR from any responsibility as to the adequacy of the forming, shoring and bracing design. Any formwork installed by CONTRACTOR shall be solely at CONTRACTOR's risk. The ENGINEER's review will not lessen or diminish the CONTRACTOR's liability. The turn-around time of the ENGINEER's review will be 2 weeks from date of receipt of each written submittal.

PART 2 PRODUCTS

2.01 FORM MATERIALS

A. Form surfaces shall be in "new and undamaged" condition and may be plywood, hard plastic finished plywood, overlaid waterproof particle board, and steel of sufficient strength and surface smoothness to produce the specified finish. The CONTRACTOR shall verify that form surfaces and panel sizes satisfy all requirements of these specifications.

B. The wall form design shall be such that wall sections can be poured full height without creating horizontal cold joints and without causing snapping of form ties which shall be of sufficient strength and number to prevent spreading of the forms during the placement of concrete and which shall permit ready removal of the forms without spalling or damaging the concrete.

2.02 FORM TIES

A. Form ties on exposed surfaces shall be located in a uniform pattern. Snap ties shall not be broken until the concrete has reached the design concrete strength. The use of

tie wires as form ties will not be permitted. Snap ties, designed so that the ends must be broken off before the forms can be removed, shall not be used.

B. Taper ties with plastic or rubber plugs of an approved and proven design may also be used. The plugs must be driven into the hole with a steel rod, placed in a cylindrical recess made therefore in the plug. At no time shall plugs be driven on the flat area outside the cylindrical recess.

2.03 FORM RELEASING AGENTS

A. Form releasing agents shall be commercial formulations that will not bond with, stain or adversely affect concrete surfaces. Agents shall not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds.

PART 3 EXECUTION

3.01 INSTALLATION

A. Forms shall be mortar tight, properly aligned and adequately supported to produce concrete surfaces meeting the surface requirements specified in Section 03300 Concrete. Forms shall be used, whenever necessary, to confine the concrete, to shape the concrete to the required lines and grades, and to obtain a thoroughly compacted dense concrete through proper vibrating. The forms shall have sufficient strength and rigidity to hold the concrete and to withstand the necessary pressure, tamping and vibration, without deflection from the prescribed lines. Where forms for continuous surfaces are placed in successive units, care shall be taken to fit the forms over the completed surface so as to obtain accurate alignment of the surface and to prevent leakage of mortar.

B. The surfaces of all forms in contact with the concrete shall be clean, rigid, tight and smooth. All dirt, chips, sawdust, mud, water and other foreign matter shall be removed from within the forms or within the excavated areas, before any concrete is deposited therein.

C. Forms shall not be reused if there is any evidence of surface wear and tear or defects which would impair the quality of the surface. Surfaces of forms to be reused shall be thoroughly cleaned of mortar from previous concreting and of all other dirt and foreign matter before reuse. Form ties that are to be completely withdrawn shall be coated with a non-staining bond breaker.

D. Bulkheads to form vertical wall joints shall be strong enough to withstand concrete pressures during pouring and vibrating, and shall be properly placed between the forms to avoid mortar seepage. Holes shall be provided in the bulkheads to permit

passage of horizontal mild steel reinforcing where required by the Drawings. Unless these are specifically called for on the Drawings, no chamfer strips shall be placed in the corners of vertical construction joints.

3.02 COATING

A. Form inside surfaces shall be coated with a form releasing agent before the form or reinforcement is placed in final position. The coating shall be used as recommended in the manufacturer's printed or written instructions. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.

3.03 ALIGNMENT AND TOLERANCES

A. Forms shall be properly aligned and adequately supported to produce concrete surfaces conforming to construction tolerance given in Table 3-1, Tolerances for Formed Surfaces.

TABLE 3-1
TOLERANCES FOR FORMED SURFACES

1	Variations from the plumb:	In any 10 feet of length ..... 1/4 inch
	a. In the lines and surfaces of columns, piers, walls and in arises	Maximum for entire length ..... 1 inch
	b. For exposed corner columns, control-joint grooves, and other conspicuous lines	In any 20 feet of length ..... 1/4 inch Maximum for entire length ..... 1/2 inch
2	Variation from the level or from the grades indicated on the drawings	In any 10 feet of length ..... 1/4 inch In any bay or in any 20 feet of length ..... 3/8 inch
3	Variation of the linear building lines from established position in plan	In any 20 feet ..... 1/2 inch Maximum ..... 1 inch
4	Variation of distance between walls, columns, partitions	1/4 inch per 10 feet of distance, but not more than 1/2 inch in any one bay, and not more than 1 inch total variation
5	Variation in the thickness of slabs and walls	Minus ..... 1/4 inch Plus..... 1/2 inch

3.04 FORM REMOVAL

A. Forms shall be removed in a manner that will prevent injury to the concrete and ensure the complete safety of the structure. Forms shall not be removed until approval is given by the ENGINEER. Formwork for columns, walls, side of beams and other parts not supporting the weight of concrete may be removed when the concrete has attained sufficient strength to resist damage from the removal operation but not before at least 24 hours has elapsed since concrete placement.

B. CONTRACTOR shall remove all wood splinters on concrete surfaces after stripping of wood forms.

- END OF SECTION -

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SUMMARY

A. This section covers the reinforcing steel bars, wire fabric or rod mats for cast-in-place concrete.

1.02 MEASUREMENT AND PAYMENT

A. Concrete reinforcement shall not be measured or paid as a separate item, but shall be included as part of the Lump Sum Cost.

1.03 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN CONCRETE INSTITUTE (ACI)

ACI 301 Specifications for Structural Concrete for Buildings.
ACI 315 Details and Detailing of Concrete Reinforcement.
ACI 318 (1989; 318R-89) Building Code Requirements for Reinforced Concrete.
ACI 350R Environmental Engineering Concrete Structures.

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 82 Standard Specifications for Steel Wire, Plain, for Concrete Reinforcement.
ASTM A 184 (1988) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
ASTM A 185 (1988) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 615 Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

D. CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI DA4 (1990; 25th Ed) Manual of Standard Practice

1.01 SUBMITTALS

A. The following shall be submitted:

1. Drawings of Concrete Reinforcement System with details showing reinforcing steel schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing.

2. Reinforcing Steel with certified copies of mill reports attesting that the reinforcing steel furnished meets the requirements specified, prior to the installation of reinforcing steel.

1.02 DELIVERY AND STORAGE

A. Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

PART 2 PRODUCTS

2.01 DOWELS

A. Dowels shall conform to ASTM A 615, Grade 60.

2.02 FABRICATED BAR MATS

A. Fabricated bar mats shall conform to ASTM A 184.

2.03 REINFORCING STEEL

A. Reinforcing steel shall be deformed bars conforming to ASTM A 615 grades and sizes as indicated. Cold drawn wire used for spiral reinforcement shall conform to ASTM A 82. When no grade is indicated use 60 ksi grade steel. Special coated bars (epoxy and zinc) may be specified for use in a highly corrosive atmosphere where concrete cover is not considered sufficient. In which case reference to ASTM A 767 and A 775 will be included.

2.04 WELDED WIRE FABRIC

A. Welded wire fabric shall conform to ASTM A 185 or ASTM A 497.

2.05 WIRE TIES

A. Wire ties shall be 16-gauge or heavier black annealed steel wire.

2.06 SUPPORTS

A. Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI DA4 and shall be steel or precast concrete blocks. Precast concrete blocks shall be not less than 4 inches square when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within 1/2 inch of concrete surface shall be plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

PART 3 EXECUTION

3.01 REINFORCEMENT

A. Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. Bars shall not be bent after embedment in concrete.

B. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life or safety.

C. Placement:

1. Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete.

2. Reinforcement shall be placed in accordance with ACI 318 at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the

resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

D. Splicing:

1. Splices of reinforcement shall conform to ACI 318 and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical connection; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 6-inches. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line.

3.02 WELDED-WIRE FABRIC

A. Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in slabs on grade shall be continuous between expansion, construction, and contraction joints. Lap splices shall be made in such a way that the overlapped area equals the distance between the outermost cross wires plus 2 inches. Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed 4 feet. Fabric shall be positioned by the use of supports.

3.03 DOWELS

A. Dowels shall be installed in slabs on grade at locations indicated and at right angles to joint being doweled. Dowels shall be accurately aligned parallel to the finished concrete surface and rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

- END OF SECTION -

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. This section covers cast-in-place concrete.

1.02 RELATED WORK

A. Related work specified in other sections includes but is not limited to:

Section 02222 - Excavation and Backfill for Structures
Section 03100 - Concrete Formwork
Section 03200 - Concrete Reinforcement

1.03 MEASUREMENT AND PAYMENT

A. Cast-in-place concrete shall not be measured or paid as a separate item, but shall be included as part of the Lump Sum Cost.

1.04 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN CONCRETE INSTITUTE (ACI)

ACI	117	Standard Tolerances for Concrete Construction and Materials
ACI	211	Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI	301	Structural Concrete for Buildings
ACI	305R	Hot Weather Concreting
ACI	306R	Cold Weather Concreting
ACI	318	Building Code Requirements for Reinforced Concrete
ACI	350R	Environmental Engineering Concrete Structures

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 31	Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(1990) Concrete Aggregates

ASTM C 39 Compressive Strength of Cylindrical Concrete Specimens
ASTM C 42 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 78 Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading)
ASTM C 94 Ready-Mixed Concrete
ASTM C 109 Compressive Strength of Hydraulic Cement Mortars(Using 2-in. or 50-mm Cube Specimens)
ASTM C 143 Slump of Hydraulic Cement Concrete
ASTM C 150 Portland Cement
ASTM C 171 Sheet Materials for Curing Concrete
ASTM C 172 Sampling Freshly Mixed Concrete
ASTM C 173 Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 192 Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231 Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260 Specification for Air-Entraining Admixtures for Concrete
ASTM C 309 Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 494 Chemical Admixtures for Concrete
ASTM C 618 Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
ASTM C 1107 Packaged Dry, Hydraulic-Cement Grout (Nonshrinkable)

1.01 DEFINITIONS

A. Average Strength (f_{cr}): The required average strength for 30 consecutive strength tests which statistically assures not more than the permissible proportions of tests will fall below Specified Strength.

B. Specified Strength (f_c'): The indicated strength.

1.02 SUBMITTALS

A. The following shall be submitted in accordance with Section 01300 - Contractor Submittals.

B. The results of trial mix designs along with a statement giving the maximum nominal coarse aggregate size and the proportions of all ingredients that will be used in the manufacture of each strength of concrete, at least 14 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an independent commercial testing laboratory, attesting that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the work without additional tests to show that the quality of the

concrete is satisfactory. Indicate whether mixes have been designed for pumping. Include in the report the following information:

1. Water-cement ratio.

2. Proportion of materials in the mix.

3. Source and type of cement.

4. Analysis of water to be used unless potable.

5. Type and name of admixtures applied. Indicate when accelerating or retarding admixtures are to be used and the resulting change in placement times.

6. Slump, air content and temperature of samples.

7. Unit weight of fresh and dry light weight concrete.

C. Pre-approved Mix Design Data: If supplier has on record, an OWNER approved mix design, submit name and address of supplier for each mix design 1 day prior to using concrete mix.

D. Certified copies of laboratory test reports, including all test data, for aggregate, admixtures, and curing compound. These tests shall be made by an approved commercial laboratory or by a laboratory maintained by the manufacturers of the materials.

E. Cementitious Materials showing Manufacturer's certification of compliance, accompanied by mill test reports attesting that the materials meet the requirements of the specification under which it is furnished, for cement and pozzolan.

1.03 QUALITY ASSURANCE

A. Do not change material sources, type of cement, air-entraining agent, water reducing agent, other admixtures, or aggregate without ENGINEER’s approval.

B. In proportioning materials for mixing, use scales certified by the State of Utah. Do not use volume measurement except for water and liquid admixtures.

C. Do not change the quantity of cement per cubic yard for approved mix design without written approval of ENGINEER.

D. Use of admixtures will not relax hot or cold weather placement requirements.

E. Ready-mixed concrete to be in accordance with Alternate No. 3 of ASTM C-94 and requirements in this Section.

F. Tolerances for concrete construction and materials shall be in accordance with ACI117.

1.04 PRODUCT STORAGE AND HANDLING

A. Store bagged and bulk cement in weatherproof enclosures to exclude moisture and contaminants.

B. Stockpile aggregate to avoid segregation and prevent contamination.

C. Avoid contamination, evaporation, or damage to admixtures. Protect liquid admixtures from freezing.

PART 2 PRODUCTS

2.01 PRECAST CONCRETE TYPE

A. All precast concrete used in the construction of seer lift stations shall be of DuraCrete® and no other.

2.02 ADMIXTURES

A. Air Entrainment: ASTM C 260.

B. Later Reducing and Set Retarding Agents: ASTM C494.

1. Type A: Set water reducing.
2. Type B: Set retarding.
3. Type C: Set accelerating.
4. Type D: Water reducing and set retarding.
5. Type E: Water reducing and set accelerating.
6. Type F: High range water reducing (super plasticizer).*
7. Type G: High range water reducing and set retarding.*

* The relative durability factor of water reducing admixtures shall not be less than 80 and the chlorides content (as C1-) expressed as a percent of the cement shall not exceed .1 percent by weight.

C. Calcium Chloride: None allowed.

D. Pozzolan: Pozzolan conforming to the requirements of ASTM C 618, Class F, is allowed as a Portland cement replacing agent under the following conditions:

1. The maximum percentage of Portland cement replacement is:
   a. 15 percent, for concrete exposed to weather.
   b. 20 percent, for interior concrete.

2. Pozzolan should not exceed 25% by weight of the cement plus Pozzolans.

3. The minimum cement content shall be used in the design formulas before replacement is made.

4. Loss of ignition of pozzolan is less than 3 percent and the water requirement does not exceed 100 percent.

5. All other requirements of this section still apply.

6. Mix designs including trial batches are required for each aggregate source and for each concrete class.

2.03 CEMENTITIOUS MATERIALS

A. Cementitious materials shall each be of one type and from one source when used in concrete which will have surfaces exposed in the finished structure. Cementitious materials shall conform to one of the following:

1. Cement: Use Portland cement, ASTM C 150, Type II, Type IIA, or Type V, low alkali, unless noted otherwise.

2. Portland - Pozzolan Cement: ASTM C-595, Type IP-A(MS). Do not use Pozzolan cement unless approved by the ENGINEER.

B. Only one brand of cement from one manufacturing plant may be used.

2.04 AGGREGATES

A. Aggregates shall be natural aggregates, free from deleterious coatings, and shall conform to the requirements of ASTM C 33, except as modified herein. Aggregates shall not be potentially reactive as defined in Appendix XI of ASTM C 33. The CONTRACTOR shall import non-reactive aggregates if local aggregates are reactive.

B. Fine Aggregates

1. Fine aggregate shall consist of clean, sharp, natural sand and shall conform to the requirements of ASTM C 33. Fine aggregate shall be graded as follows:

SIEVE SIZE	PERCENT PASSING BY WEIGHT
3/8 inch	100
#4	95-100
#8	80-100
#16	50-85
#30	25-60
#50	10-30
#100	2-10

2. Fine aggregates shall have no more than two percent by weight passing #200 sieve.

C. Coarse Aggregate

1. Coarse aggregate shall be washed gravel or crushed stone, or a combination of these materials, consisting of hard, tough, durable particles free from adherent coatings. It shall contain no more than 15 percent flat or elongated particles. A thin, flat or elongated particle is defined as a particle having a maximum dimension in excess of five times its minimum dimension. Aggregate which has disintegrated or weathered badly under exposure conditions similar to those which will be encountered in the work under consideration shall be not be used. Coarse aggregate shall be graded as follows (ASTM C 33):

SIEVE SIZE	PERCENT PASSING BY WEIGHT
1-1/2 inch	100

1 inch	95-100
1/2 inch	25-60
#4	0-10
#8	0-5

2. Coarse aggregates shall have no more than 1.75 percent by weight passing #200 sieve. Proof of gradation will be provided to ENGINEER by the CONTRACTOR.

2.05 ACI MIX DESIGN

A. The amount by which the average strength (f_{cr}) of a concrete mix exceeds the specified compressive strength (f'_c) shall be based upon no more than 1 in 100 random individual strength tests falling more than 500 psi below the specific strength.

B. Proportion the materials in accordance with ACI 211.1, 211.2 or 211.3 as applicable to produce concrete having the properties or limitations of Table No. 03300-A.

2.06 HAND MIXING

A. Do not hand mix batches exceeding 0.5 cubic yards.

B. Hand mix only on watertight platform. Mix cement and aggregate prior to adding water.

C. Ensure all stones are thoroughly covered with mortar and mixture is of uniform color and consistency.

2.07 HEATING, WATER AND AGGREGATE

A. Do not allow products of fuel combustion to contact the aggregate.

B. Heat mixing water 150 degrees F. maximum. Heat aggregates uniformly.

C. Do not mix cement with water and aggregate at a mix temperature greater than 100 degrees F.

2.08 WATER

A. Water shall be potable, except that non-potable water may be used if it produces mortar cubes having 7- and 28-day strengths at least 90 percent of the strength of similar specimens made with water from a municipal supply. The strength comparison shall be made on mortars, identical except for mixing water, prepared and tested in accordance with ASTM C 109. Water for curing shall not contain any substance injurious to concrete, or which causes staining.

2.09 PROPORTIONS OF MIX

A. Mixture Proportioning, Normal Weight Concrete: All concrete that must be watertight and resistant to freeze-thaw cycles and to naturally occurring or commonly used chemicals should be air entrained. All materials should be proportioned to produce a well-graded mixture of high density and maximum workability with a minimum specified 28 day compressive strength of 4000 psi. Trial batches shall contain materials proposed to be used in the project. Trial mixtures having proportions, consistencies and air content suitable for the work shall be made based on methodology described in ACI 211.1, using at least three different water-cement ratios. Trial mixes shall be proportioned to produce concrete strengths specified. In the case where ground iron blast-furnace slag is used, the weight of the slag will be substituted in the equations for the term P which is used to denote the weight of pozzolan. Trial mixtures shall be designed for maximum permitted slump and air content. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 192. They shall be tested at 7 and 28 days in accordance with ASTM C 39. From these test results a curve shall be plotted showing the relationship between water-cement ratio and strength. Maximum water-cement or water-cement plus Pozzolan Ratio: 0.45.

B. Average Strength: In meeting the strength requirements specified, the selected mixture proportion shall produce an average compressive strength exceeding the specified strength by the amount indicated below. Where a concrete production facility has test records, a standard deviation shall be established. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected; shall represent concrete produced to meet a specified strength or strengths within 1000 psi of that specified for proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days or at other test age designated for determination of the specified strength.

2.10 CONCRETE PROPERTIES

A. Exterior Cast-in-Place Concrete Structures: Class 4000 minimum in accordance with the following table and ACI 318, unless a different strength of concrete is indicated.

B. Interior Cast-in-Place Concrete: Class 3000 minimum in accordance with the following table and ACI 318, unless a different strength of concrete is indicated.

TABLE NO. 03300-A

CONCRETE MIX PROPERTIES (e)				
CONCRETE PROPERTIES	CONCRETE CLASSIFICATION(S)			
	Class 5000	Class 4000	Class 3500	Class 3000
Specified Compressive Strength $f_{c'}$ at 28 days, min., psi	5000	4000	3500 (d)	3000 (d)
Compressive Strength at 7 days, min., psi (a)	3550	2680	2345	2010
Cement content (94 lb. sacks of cement per cubic yard of concrete), min. (b)	7.0	6.0	5.75	5.5
Entrained air content, (% by volume).	6±1	6±1	6±1	6±1
Slump Range, in. (c)		1 - 4 (f)	2 - 4	2 - 4

(a) Used for monitoring purposes only.
(b) May include pozzolan replacements if accepted by ENGINEER.
(c) Not more than 8 inches after adding high range water reducing admixture (super-plasticizer) at site.
(d) Not allowed if concrete is exposed to freezing and thawing temperatures. Use Class 4000 or higher compressive strength and 6±1.0 percent air entrainment.
(e) All mix designs must be approved by ENGINEER.
(f) 1"-3" for footings, substructural walls and 1"-4" for slabs, beams, reinforced walls and columns.

PART 3 EXECUTION

3.01 PREPARATION OF SURFACES

A. Surfaces to receive concrete shall be clean and free from frost, snow, ice, mud, and water. Conduit and other similar items shall be in place and clean of any deleterious substance.

B. Foundations: Earthwork shall be as specified. Flowing water shall be diverted without washing over freshly deposited concrete. Rock foundations shall be cleaned by high velocity air-water jets, sandblasting, or other approved methods. Debris and loose, semi-detached or unsound fragments shall be removed. Rock surfaces shall be moist but without free water when concrete is placed. Semiporous subgrades for foundations and footings shall be damp when concrete is placed. Pervious subgrades shall be sealed by blending impervious material with the top 6 inches of the in-place pervious material or by covering with an impervious membrane.

C. Preparation of Previously Placed Concrete: Concrete surfaces to which other concrete is to be bonded shall be roughened in an approved manner that will expose sound aggregate uniformly without damaging the concrete. Laitance and loose particles shall be removed. Surfaces shall be moist but without free water when concrete is placed.

3.02 INSTALLATION OF EMBEDDED ITEMS

A. Embedded items shall be free from oil, loose scale or rust, and paint. Embedded items shall be installed at the locations indicated and required to serve the intended purpose. Voids in sleeves, slots and inserts shall be filled with readily removable material to prevent the entry of concrete.

3.03 BATCHING, MIXING AND TRANSPORTING CONCRETE

A. Ready-mixed concrete shall be batched, mixed and transported in accordance with ASTM C 94, except as otherwise specified. Truck mixers, agitators, and nonagitating units shall comply with NRMCA TMMB-1. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA-QC 3.

B. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quantity and quality of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the ENGINEER.

C. Truck mixers and their operation shall be such that the concrete throughout the mixed batch as discharged is within acceptable limits of uniformity with respect to consistency, mix, and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than 1 inch when

the specified slump is 3 inches or less, or more than 2 inches when the specified slump is more than 3 inches, the mixer shall not be used on the work unless the causing condition is corrected and satisfactory performance is verified by additional slump tests. All mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit, and clearance of the drum, shall be checked before a further attempt to used the unit will be permitted.

D. Admixtures: Admixtures shall be batched within an accuracy of 3 percent. Where two or more admixtures are used in the same batch, they shall be batched separately and must be compatible. Retarding admixture shall be added within one minute after addition of water is complete or in the first quarter of the required mixing time, whichever is first. Superplasticizing admixtures shall be added at the project site, and the concrete with the admixture shall be mixed 4 to 5 minutes before placing as recommended by manufacturer. Concrete that shows evidence of total collapse or segregation caused by the use of admixture shall be removed from the site.

E. Control of Mixing Water: No water from the truck system or elsewhere shall be added after the initial introduction of mixing water for the batch. No water shall be added at the jobsite without the approval of the ENGINEER.

3.04 SAMPLING AND TESTING

A. Sampling and Testing of the concrete will be by the developer/contractor or his representatives. The Contractor shall assist the developer/contractor's representative at the site with concrete testing.

1. Aggregates: Aggregates for normal weight concrete shall be sampled and tested in accordance with ASTM C 33.

2. Sampling of Concrete: Samples of concrete for air, slump, unit weight, and strength tests shall be taken in accordance with ASTM C 172.
   a. Air Content: Test for air content shall be performed in accordance with ASTM C 173 or ASTM C 231. A minimum of 1 test shall be conducted each time a slump test is made.
   b. Slump: At least 1 slump test shall be made on randomly selected batches of each mixture of concrete for every 50 cubic yards of ready-mixed concrete delivered to the job site. Also note the time batched at the plant and the starting time when unloading began at the site. Tests shall be performed in accordance with ASTM C 143.
   c. Temperature: Concrete and air temperatures shall be measured and recorded with each set of cylinders and the air temperature shall also

be recorded when the air temperature at the site is 40 degrees F or below and/or 90 degrees F or above.

3. Evaluation and Acceptance of Concrete
   a. Frequency of Testing: Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, nor less than once for each 50 cubic yards of concrete, nor less than once for each 3000 square feet of surface area for slabs or walls. If this sampling frequency results in less than 5 strength tests for a given class of concrete, tests shall be made from at least 5 randomly selected trucks or from each truck if fewer than 5 truck loads are used. Field cured specimens for determining form removal time or when a structure may be put in service shall be made in numbers directed to check the adequacy of curing and protection of concrete in the structure. The specimens shall be removed from the molds at the age of 24 hours and shall be cured and protected, insofar as practicable, in the same manner as that given to the portion of the structure the samples represent.
   b. Testing Procedures: Cylinders for acceptance tests shall be molded and cured in accordance with ASTM C 31. Cylinders shall be tested in accordance with ASTM C 39. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days or at another specified test age.
   c. Evaluation of Results: Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength and no individual strength test result falls below the required strength by more than 500 pounds per square inch.
   d. Unless noted otherwise, make a minimum of four (4) concrete cylinders each time a test is required. When concrete is being placed in suspended slabs, beams and retaining walls make two (2) extra cylinders which must be cured on site. The extra cylinders will be used to determine when to remove forms and/or when to backfill.

B. Investigation of Low-Strength Test Results: When any strength test of standard-cured test cylinder falls below the specified strength requirement by more than 500 pounds per square inch, or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that load-carrying capacity of the structure is not jeopardized. Nondestructive testing in accordance with ASTM C 597, ASTM C 803 or ASTM C 805 may be permitted by the ENGINEER to determine the relative strengths at various locations in the structure as an aid in evaluating concrete strength in place or for selecting areas to be cored. Such tests, unless properly calibrated and correlated with other test data, shall not be used

as a basis for acceptance or rejection. When strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with ASTM C 42. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores shall be determined by the ENGINEER to least impair the strength of the structure. If the concrete in the structure will be dry under service conditions, the cores shall be air dried (temperature 60 to 80 degrees F, relative humidity less than 60 percent) for seven days before testing and shall be tested dry. If the concrete in the structure will be more than superficially wet under service conditions, the cores shall be tested after moisture conditioning in accordance with ASTM C 42. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to or at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. If the core tests are inconclusive or impractical to obtain, or if structural analysis does not confirm the safety of the structure, load tests may be directed by the ENGINEER in accordance with the requirements of ACI 318. Concrete work evaluated by structural analysis or by results of a load test and found deficient shall be corrected in a manner satisfactory to the ENGINEER. All investigations, testing, load tests, and correction of deficiencies shall be performed, and approved by the ENGINEER, at the expense of the Contractor.

3.05 CONVEYING CONCRETE

A. Concrete shall be conveyed from mixer to forms as rapidly as possible and within the time interval specified in paragraph CONCRETE PLACEMENT by methods which will prevent segregation or loss of ingredients.

1. Chutes: When concrete can be placed directly from a truck mixer or other transporting equipment, chutes attached to this equipment may be used. Separate chutes will not be permitted except when specifically approved.

2. Buckets: Bucket design shall be such that concrete of the required slump can be readily discharged. Bucket gates shall be essentially grout tight when closed. The bucket shall provide means for positive regulations of the amount and rate of deposit of concrete in each dumping position.

3. Belt Conveyors: Belt conveyors may be used when approved. Belt conveyors shall be designed for conveying concrete and shall be operated to assure a uniform flow of concrete to the final place of deposit without segregation or loss of mortar. Conveyors shall be provided with positive means for preventing segregation of the concrete at transfer points and point of placement.

4. Pumps: Concrete may be conveyed by positive displacement pumps when approved. Pump shall be the piston or squeeze pressure type. Pipeline shall be steel pipe or heavy duty flexible hose. Inside diameter of the pipe shall be at least three times the maximum size of the coarse aggregate. Distance to be pumped shall not exceed the limits recommended by the pump manufacturer. Concrete shall be supplied to the pump continuously. When pumping is completed, the concrete remaining in the pipeline shall be ejected without contaminating the concrete in place. After each use, the equipment shall be thoroughly cleaned. Flushing water shall be wasted outside the forms.

3.06 CONCRETE PLACEMENT

A. Mixed concrete which is transported in truck mixers or agitators or concrete which is truck mixed, shall be discharged within 1-1/2 hours or before the drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregates. These limitations may be waived by the ENGINEER if the concrete is of such slump after the 1-1/2 hour time or 300 revolution limit has been reached that it can be placed, without the addition of water to the batch. When the concrete temperature exceeds 85 degrees F, the time shall be reduced to 45 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the truck.

1. Placing Operation: Concrete shall be handled from mixer to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by the CONTRACTOR prevent proper consolidation, finishing and curing. Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 4 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Concrete should not be allowed to drop through a cage of reinforcing steel. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 12 inches thick, except that all slabs shall be placed in a single layer. Concrete to receive other construction shall be screened to the proper level to avoid excessive shimming or grouting.

2. Consolidation: Immediately after placing, each layer of concrete shall be consolidated by internal vibrators, except for slabs 4 inches or less. The vibrators shall at all times be adequate in effectiveness and number to

properly consolidate the concrete; a spare vibrator shall be kept at the jobsite during all concrete placing operations. The vibrators shall have a frequency of not less than 8000 vibrations per minute, and the head diameter and amplitude shall be appropriate for the concrete mixture being placed. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a few inches. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding layer if there is such. Vibrator shall be held stationary until the concrete is consolidated and then withdrawn slowly. The use of form vibrators must be specifically approved. Vibrators shall not be used to transport concrete within the forms. Slabs 4 inches and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique.

B. Cold Weather Requirements: Special protection measures, approved by the ENGINEER, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. Provisions should be made to keep the concrete at a minimum temperature of 50 degrees F for 7 days. The ambient temperature of the air where concrete is to be placed and the temperature of surfaces to receive concrete shall be not less than 40 degrees F. No concrete shall be placed on frozen ground. The temperature of the concrete when placed shall be not less than 55 degrees F nor more than 75 degrees F. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Calcium chloride shall not be used.

C. Hot Weather Requirements: The temperature of the concrete placed during hot weather shall not exceed 85 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. In no case shall the placing temperature exceed 95 degrees F.

3.07 CONSTRUCTION JOINTS

A. Construction joints shall be located as indicated or approved. Where concrete work is interrupted by weather, end of work shift or other similar type of delay, location and type of construction joint shall be subject to approval of the ENGINEER. Unless otherwise indicated and except for slabs on grade, reinforcing steel shall extend through construction joints. Construction joints in slabs on grade shall be keyed or doweled as shown. Concrete columns, walls, or piers shall be in place at least 2

hours, or until the concrete is no longer plastic, before placing concrete for beams, girders, or slabs thereon. In walls having door or window openings, lifts shall terminate at the top and bottom of the opening. Other lifts shall terminate at such levels as to conform to structural requirements or architectural details. Where horizontal construction joints are required, a strip of 1-inch square-edge lumber, beveled and oiled to facilitate removal shall be tacked to the inside of the forms at the construction joint. Concrete shall be placed to a point 1 inch above the underside of the strip. The strip shall be removed 1 hour after the concrete has been placed, and any irregularities in the joint line shall be leveled off with a wood float, and all laitance shall be removed. Prior to placing additional concrete, horizontal construction joints shall be prepared as specified in paragraph 3.01, PREPARATION OF SURFACES.

3.08 FINISHING CONCRETE

A. Formed Surfaces

1. Repair of Surface Defects: Surface defects shall be repaired within 24 hours after the removal of forms. Honeycombed and other defective areas shall be cut back to solid concrete or to a depth of not less than 1 inch, whichever is greater. Edges shall be cut perpendicular to the surface of the concrete. The prepared areas shall be dampened and brush-coated with neat cement grout. The repair shall be made using mortar consisting of not more than 1 part cement to 2-1/2 parts sand. The mixed mortar shall be allowed to stand to stiffen (approximately 45 minutes), during which time the mortar shall be intermittently remixed without the addition of water. After the mortar has attained the stiffest consistency that will permit placing, the patching mix shall be thoroughly tamped into place by means approved by the ENGINEER and finished slightly higher than the surrounding surface. For Class A and Class B finished surfaces the cement used in the patching mortar shall be a blend of job cement and white cement proportioned to produce a finished repair surface matching, after curing, the color of adjacent surfaces. Holes left after the removal of form ties shall be cleaned and filled with patching mortar. Holes left by the removal of tie rods shall be reamed and filled by dry-packing. Repaired surfaces shall be cured as required for adjacent surfaces. The temperature of concrete, mortar patching material, and ambient air shall be above 50 degrees F while making repairs and during the curing period. Concrete with defects which affect the strength of the member or with excessive honeycombs will be rejected, or the defects shall be corrected as directed.

2. Class A Finish: Where a Class A finish is indicated, fins shall be removed immediately upon removal of forms. A mortar mix consisting of one part portland cement and two parts well-graded sand passing a No. 30 sieve, with water added to give the consistency of thick paint, shall be prepared. White cement shall be used to replace part of the job cement. After the surface has been thoroughly wetted and allowed to approach surface dryness, the mortar shall be vigorously applied to the area by brick rubbing, to completely fill all surface voids. Excess grout shall be scraped off with a trowel. As soon as it can be accomplished without pulling the mortar from the voids, the area shall be rubbed with burlap pads until all visible grout film is removed. The rubbing pads shall have on their surfaces the same sand-cement mix specified above but without any mixing water. The finish of any area shall be completed in the same day, and the limits of a finished area shall be made at natural breaks in the surface. The surface shall be continuously moist cured for 48 hours. The temperature of the air adjacent to the surface shall be not less than 50 degrees F for 24 hours prior to, and 48 hours after, the application. In hot, dry weather the smooth finish shall be applied in shaded areas.

3. Class B Finish: Where a Class B finish is indicated, fins shall be removed. Concrete surface shall be smooth with a texture at least equal to that obtained through the use of Grade B-B plywood forms.

4. Class C Finish: Where a Class C finish is indicated, fins shall be removed. Concrete surfaces shall be relatively smooth with a texture imparted by the forms used.

5. Class D Finish: Where a Class D finish is indicated, fins exceeding 1/4 inch in height shall be chipped or rubbed off. Concrete surfaces shall be left with the texture imparted by the forms used.

B. Unformed Surfaces: In cold weather, the air temperature in areas where concrete is being finished shall not be less than 50 degrees F. In hot windy weather when the rate of evaporation of surface moisture, as determined by methodology presented in ACI 305R, may reasonably be expected to exceed 0.2 pounds per square foot per hour; coverings, windbreaks, or fog sprays shall be provided as necessary to prevent premature setting and drying of the surface. The dusting of surfaces with dry materials or the addition of water during finishing will not be permitted. Finished surfaces shall be plane, with no deviation greater than 5/16-inch when tested with a 10-foot straightedge. Surfaces shall be pitched to drains.

1. Rough-Slab Finish: Slabs to receive fill or mortar setting beds shall be screened with straightedges immediately after consolidation to bring the surface to the required finish level with no coarse aggregate visible.

2. Float Finish: Slabs to receive a steel trowel finish and slabs where indicated shall be given a float finish. Screeding shall be followed immediately by darbying or bull floating before bleeding water is present, to bring the surface to a true, even plane. After the concrete has stiffened to permit the operation and the water sheen has disappeared, it shall be wood floated. Concrete that portrays stickiness shall be finished with a magnesium float in lieu of a wood float, and left free of ridges and other projections. Float finish is normally specified for surfaces that will receive other treatment such as built-up roofing, nonslip surfacing material. Float Finish shall not be used on wearing surfaces.

3. Trowel Finish: Slabs where indicated, shall be given a trowel finish immediately following floating. Surfaces shall be troweled to produce smooth, dense slabs free from blemishes including trowel marks. In lieu of hand finishing, an approved power finishing machine may be used in accordance with the directions of the machine manufacturer. A final hard steel troweling shall be done by hand. Trowel finish shall be used on wearing surfaces and where a smooth finish is required.

4. Broom Finish: After floating, slabs where indicated, shall be lightly trowelled, and then broomed with a fiber-bristle brush in a direction perpendicular to that of the main traffic.

3.09 CURING AND PROTECTION

A. General: All concrete shall be cured by an approved method for the period of time given below:

Concrete with Type III cement	3 days
Concrete with Type II or IIA, or V, low alkali cement	7 days
Concrete with Type IP-A(MS) cement blended with pozzolan	10 days

B. Immediately after placement, concrete shall be protected from premature drying extremes in temperatures, rapid temperature change, mechanical injury and injury

from rain and flowing water. Air and forms in contact with concrete shall be maintained at a temperature above 50 degrees F for the first 3 days and at a temperature above 32 degrees F for the remainder of the specified curing period. Exhaust fumes from combustion heating units shall be vented to the outside of the enclosure and heaters and ducts shall be placed and directed so as not to cause areas of overheating and drying of concrete surfaces or to create fire hazards. All materials and equipment needed for adequate curing and protection shall be available and at the site prior to placing concrete. No fire or excessive heat shall be permitted near or in direct contact with the concrete at any time. Curing shall be accomplished by any of the following methods, or combination thereof, as approved.

C. Moist Curing: Concrete to be moist-cured shall be maintained continuously wet for the entire curing period. If water or curing materials used stains or discolors concrete surfaces which are to be permanently exposed, the concrete surfaces shall be cleaned. When wooden forms are left in place during curing, they shall be kept wet at all times. If the forms are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Horizontal surfaces shall be cured by ponding, by covering with a 2-inch minimum thickness of continuously saturated sand, or by covering with waterproof paper, polyethylene sheet, polyethylene-coated burlap or saturated burlap. Once the moist curing has started the concrete surface must not be allowed to become surface dry for the entire curing period.

D. Membrane Curing: Membrane curing shall not be used on surfaces that are to receive any subsequent treatment depending on adhesion or bonding to the concrete; except a styrene acrylate or chlorinated rubber compound meeting ASTM C 309, Class B requirements may be used for surfaces which are to be painted or are to receive bituminous roofing or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing or flooring specified. Membrane curing compound shall not be used on surfaces that are maintained at curing temperatures with free steam. Curing compound shall be applied to formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface. Surfaces shall be thoroughly moistened with water and the curing compound shall be applied to slab surfaces as soon as the bleeding water has disappeared, with the tops of joints being temporarily sealed to prevent entry of the compound and to prevent moisture loss during the curing period. Compound shall be applied in a one-coat continuous operation by mechanical spraying equipment, at a uniform coverage in accordance with the manufacturer's printed instructions. Concrete surfaces which have been subjected to rainfall within 3 hours after curing compound has been applied shall be resprayed by the method and at the coverage specified. On surfaces permanently exposed to view, the surface shall be shaded from direct rays of the sun

for the duration of the curing period. Surfaces coated with curing compound shall be kept free of foot and vehicular traffic, and from other sources of abrasion and contamination during the curing period.

- END OF SECTION -

SECTION 03310

PRECAST CONCRETE VAULT

PART 1 GENERAL

1.01 DESCRIPTION

A. This section includes the materials and installation of precast concrete vaults.

1.02 REFERENCES

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for:

ACI 318 - Building Code Requirements for Reinforced Concrete
ASTM A 48 - Gray Iron Castings
ASTM A 615A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement, Grade 60
ASTM C 478 - Precast Reinforced Concrete Manhole Sections

1.03 SUBMITTALS

A. The following shall be submitted:

1. Certified copies of test reports demonstrating conformance to applicable pipe specifications, before pipe is installed.
2. Manufacturer's catalog data on precast items. Provide details and dimensions of the vault including reinforcing steel, the thickness of concrete sections, and locations of the hatches, and other required items.

1.04 RELATED WORK SPECIFIED ELSEWHERE

Section 11223 Submersible Lift Station

1.05 DESIGN REQUIREMENTS

A. Precast concrete vaults and access doors shall be designed for H-20 highway wheel loading.
B. Entire interior shall be coated with Dynastone in the manner and thickness recommended by the manufacturer.

1.05 MEASUREMENT AND PAYMENT

B. Precast Concrete Vault shall not be measured or paid for separately, but shall be included in the Lump Sum Cost.

PART 2 PRODUCTS

2.01 PRECAST CONCRETE VAULT

A. Precast components and appurtenant materials shall be as manufactured by ARMCO or accepted equal, and shall comply with applicable portions of ASTM C 478 and the Drawings.

B. Reinforcing steel shall conform to ASTM A 615, Grade 60. Installation of reinforcing steel shall conform to ACI 318. Welding of reinforcing steel is prohibited.

C. Precast vault components shall conform to the shapes and dimensions indicated on the Approved Plans. The minimum wall thickness shall be 150mm (6”).

D. Openings or "knockouts" in precast concrete vaults shall be located as shown on the Drawings and shall be sized sufficiently to permit passage of the largest outside dimension of pipe.

E. The precast vault base or floor slab shall be grouted as shown on the Drawings to slope to the pumps.

2.02 CRUSHED ROCK BASE AND BACKFILL MATERIALS

A. Crushed rock base and backfill materials shall be in accordance with Section 02278.

2.03 JOINT SEALING COMPOUND

A. Joint sealing material shall be in accordance with the recommendations of the vault manufacturer.

2.04 PIPE PENETRATIONS

A. Adjustable-linked rubber seal devices or non-shrink grout shall be used to provide seals around pipe penetrations through precast concrete vaults.

2.05 VAULT ACCESS DOORS

A. Vault access doors shall be fabricated aluminum by Bilco as shown on the Drawings.

B. Access doors shall be equipped with stainless steel hardware, compression spring operators, an automatic hold-open arm with release handle, and a locking device. The frame shall incorporate a drain gutter with an outlet routed to the exterior of the precast lid.

C. All vaults shall have H-20 rated traffic doors.

PART 3 EXECUTION

3.01 EARTHWORK

A. Vault excavation, foundation stabilization if necessary, placement of base material, backfill and compaction shall be performed in accordance with Section 02222. The excavation shall be large enough to accommodate the vault structure and permit grouting of openings and backfilling operations.

3.02 INSTALLATION

A. The Vault base section shall be placed on a 150mm (6") thick minimum base of compacted crushed rock over undisturbed soils, and shall be graded level to the elevation shown on the Drawings.

B. The concrete vault base section and successive precast sections will receive a joint sealing compound prior to setting the precast sections in place. The joint sealing compound shall be installed according to the manufacturer's recommendations to provide a watertight joint, which will remain impermeable throughout the design life of the structure. Following placement of the precast sections, the joints shall be mortared and tooled to a smooth finish, free of voids.

C. Assemble the precast sections to the elevation required by the location of the vault as follows:
   1. Unpaved Easements: Top of cover shall be 150mm (6") above the ground surface.

D. Secure the vault access door in accordance with the manufacturer’s recommendations. Access doors shall be built up so that the hatch is installed as required. The Contractor is responsible for placing the cover at the proper

elevation where paving is to be installed and shall make all necessary adjustments.

F. Use non-shrink grout to seal around pipe penetrations through precast concrete vaults instead of, or in addition to, adjustable-linked rubber seal devices .

G. Where vaults are to be given a protective coating, they shall be free of seepage and surface moisture.

H. After the vault and all appurtenances are in place and are approved by the Engineer, backfill shall be placed to the original grade or to the limits shown on the approved plans. 1 cu ft of crushed rock shall be placed adjacent to the hatch gutter drain outlet.

J. Replacement of asphalt or concrete pavement shall be in accordance with the requirements of the Drawings.

-- END OF SECTION --

DIVISION 11

EQUIPMENT

SECTION 11223

SUBMERSIBLE PUMPING SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

The CONTRACTOR shall furnish, install and place into operation one new duplex, submersible pumping system, and refurbish two existing pumping stations. Like items of equipment specified herein shall be the end products of one manufacturer to achieve standardization of appearance, maintenance, spare parts, and manufacturer's services.

1.02 SUBMITTALS

The CONTRACTOR shall submit information in accordance with Section 01300, SUBMITTALS, to substantiate compliance with this specification. In addition, the following specific information shall be provided.

A. SHOP DRAWINGS

Shop drawings showing fabrication, assembly, and installation drawings, together with detailed specifications and data covering performance and materials of construction, power drive assembly, parts, devices, and other accessories forming a part of the equipment furnished shall be submitted. Data and specifications for each pump specified under this section shall include, but shall not be limited to, the following:

1. Pump curves indicating total dynamic head, flow rate, brake horsepower, shutoff head, net positive suction head, and efficiency: Curves showing the above characteristics at the specified speed within the intended range shall be submitted. Performance requirements shall be as defined in the *Hydraulics Institute Standards.*

2. Spare Parts Data: Prior to the date of commissioning the CONTRACTOR shall furnish spare parts data for each different item of materials and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

B. OPERATION AND MAINTENANCE MANUALS

Operation and maintenance manuals shall be furnished for the equipment herein specified.

1.03 APPLICABLE PUBLICATIONS

The publications listed below form an art of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

Anti-Friction Bearing Manufacturers Association (AFBMA) Standards:

St'd 9-78 *Load Ratings an Fatigue Life of Ball Bearings*

Hydraulic Institute (HI) Publications:

1983 *Hydraulic Institute Standards for Centrifugal, Rotary and Reciprocating Pumps*

National Fire Protection Association (NFPA) Publication:

No. 70-84 *National Electrical Code*

1.04 SUPPLIER'S AND/OR MANUFACTURER'S SERVICES

The CONTRACTOR shall provide the following services of technical representatives at the jobsite relating to the item(s) specified in this section. The number of days and scope of services indicated are minimum requirements not including travel time. Time for travel and all associated expenses of the technical representative shall also be included at no additional cost to the OWNER.

Two labor days - Installation assistance, inspection and functional testing, plant startup services and performance testing, and training of two personnel.

Startup services and training of the two personnel shall be such times as requested by the OWNER.

1.05 MEASUREMENT AND PAYMENT

Submersible Pumping Stations shall not be measured or paid as a separate item, but shall be included as part of the Lump Sum Cost.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Pumps and all appurtenances shall be new products of the same manufacturer: ABS, Hydromatic, or accepted equal.

2.02 SERVICE CONDITIONS

At each pump station, the design conditions must be met with only one pump on. The second pump provides 100% reserve capacity. The horsepower values listed shall not be exceeded at any point on the published curves.

Liquid pumped: Wastewater

2.03 PERFORMANCE CHARACTERISTICS

A. GREAT SALT LAKE MARINA RESTROOM GRINDER PUMPS: Hydromatic Model HPGF/HPGF300 or accepted equal.

Item	**Description**
Pump type	Duplex, Grinder
Throughlet (inch)	2
Maximum capacity (gpm)	80
Total dynamic head (ft) (min.)	18
Minimum efficiency (%)	15
Maximum speed (rpm)	1800
Nominal motor size (HP)	3
Phase	Three Phases
Voltage	460V, 60HZ
Pump Performance Curve Data	
Head (ft)	**GPM**
30.0	0.0
20.0	65
18.0	75

B. GREAT SALT LAKE MARINA MAINTENANCE BUILDING GRINDER PUMPS:

Hydromatic Model HPGF500M3/4-4 or accepted equal.

Item	Description
Pump type	Duplex, Grinder
Throughlet (inch)	2
Maximum capacity (gpm)	135
Total dynamic head (ft) (min.)	40
Minimum efficiency (%)	15
Maximum speed (rpm)	1800
Nominal motor size (HP)	5.0
Phase	Three Phases
Voltage	460V, 60HZ
Pump Performance Curve Data	
Head (ft)	**GPM**
78	0
50	120.0
40	135.0

C. SALTAIR PUMPS: ABS Model AFP1034M230/2D or accepted equal.

Item	Description
Pump type	Duplex
Throughlet (inch)	3
Maximum capacity (gpm)	350
Total dynamic head (ft) (min.)	122
Minimum efficiency (%)	10
Maximum speed (rpm)	3520
Nominal motor size (HP)	27
Phase	Three Phases
Voltage	460V, 60HZ
Pump Performance Curve Data	
Head (ft)	**GPM**
188	0.0
142	250
122	350

The installed pumping systems for the pump stations, including pumps, motors, guide bars or cables, and controls shall be suitable for and Factory Mutual listed for Class 1,

Division 1, Groups C and D hazardous locations as defined by the National Electric Code (NEC). Under the conditions hereinbefore specified and at any point on the manufacturer's published curve, the pump shall be designed and rated to operate continuously and perform smoothly without undue vibration. In no case shall the pump exceed the nameplate horsepower rating of the drive motor at any point on the published pump curve.

2.04 PUMP CONSTRUCTION DETAILS

A. GENERAL

1. **Great Salt Lake Marina Restroom - Duplex Grinder Pumps**

   These pumps shall be centrifugal-type and have grinders to handle raw sewage. These pumps shall be capable of withstanding submergence as required for the particular installation. Refer to manufacturer’s specifications for complete pump specifications.

2. **Great Salt Lake Marina Maintenance Building - Duplex Grinder Pumps**

   These pumps shall be centrifugal-type and have grinders to handle raw sewage. These pumps shall be capable of withstanding submergence as required for the particular installation. Refer to manufacturer’s specifications for complete pump specifications.

3. **Saltair - Duplex Pumps**

   These pumps shall be the solids-handling, centrifugal-type capable of passing solids up to 3.0 inches in diameter. Pumps shall be capable of withstanding submergence as required for the particular installation. Refer to manufacturer’s specifications for complete pump specifications.

B. PUMP REMOVAL

Each pump shall be easily removable from the wet well for inspection and service requiring no bolts, nuts or other fastenings to be disconnected, and consequently shall not require the entry of any personnel into the wet well. When lowered into place, pumps shall automatically connect to the discharge piping forming a tight seal without requiring adjustment, fasteners, or similar devices. The pump connection shall not leak under a test pressure of the shutoff head.

The manufacturer shall supply necessary PVC-coated cable hooks, stainless steel wire rope lifting cables, stainless steel guide bar brackets, stainless steel guide bars, and

stainless steel fasteners. The CONTRACTOR shall supply stainless steel anchor bolts. Guide rails in hazardous locations shall be non-sparking.

Each pump shall have a base mounting plate, quick disconnect discharge elbow and pump guide bracket. Sealing of the discharge interface shall be accomplished by the simple downward linear motion of the pump. No rotary motion of the pump shall be required for sealing and the pump shall be guaranteed not to leak at the discharge flange. There shall be no more than one 90° bend allowed between the volute discharge flange and station piping.

C. PUMP DESIGN

The pumps shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. No portion of the pump shall bear directly on the sump floor.

D. PUMP CONSTRUCTION

Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray epoxy coating with an epoxy paint finish on the exterior of the pump.

Sealing design shall incorporate **metal-to-metal contact** between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit. Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

E. COOLING SYSTEM

Motors shall be sufficiently cooled by the surrounding environment or pumped media. A water cooling jacket shall not be required.

F. CABLE ENTRY SEAL

The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The sealing mechanisms shall in no way compress the wires or its insulation such that their conductivities are affected. The assembly shall provide ease of changing the cable when necessary using the same entry seal.

G. MOTOR

The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air-filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class F insulation rated for 155°C (311°F).

Thermal switches set to open at 125°C (260°F) shall be embedded in the stator lead coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The switches shall automatically reset at 30º to 35º C differential. The motor and the pump shall be produced by the same manufacturer. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C.

A 3/02 performance chart shall be provided upon request showing curves for torque, current, power factor, input/ output kW and efficiency. This chart shall also include data on starting and no-load characteristics.

The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chloroprene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

H. BEARINGS

The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall compensate for axial thrust and radial forces.

I. MECHANICAL SEAL

Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall require neither maintenance nor adjustment nor **depend on direction of rotation for sealing**.

Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication.

The motor shall be able to operate dry without damage while pumping under load.

J. PUMP SHAFT

Pump and motor shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The pump shaft shall be AISI type 416 stainless steel.

K. IMPELLER

The impeller(s) shall be of gray cast iron, Class 35B, dynamically balanced, double shrouded non-clogging design having a long throughlet without acute turns. The impeller(s) shall be capable of handling 3" diameter solids, fibrous materials, heavy sludge and other matter found in wastewater.

Whenever possible, a full vaned, not vortex, impeller shall be used for maximum hydraulic efficiency; thus, reducing operating costs. Mass moment of inertia calculations shall be provided by the pump manufacturer upon request. Impeller(s) shall be, retained with an Allen head bolt. All impellers shall be coated with an epoxy primer.

L. WEAR RINGS

A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impellers. The wear ring shall made of brass, which is drive fitted to the volute inlet.

M. PROTECTION

All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. The thermal switches shall open at 125°C (260°F), stop the motor and activate an alarm. A leakage sensor shall be available as an option to detect water in the stator chamber. Use of voltage sensitive solid state sensors and trip temperature above 125°C (260 °F) shall not be allowed**.**

N. GRINDER CUTTERS (APPLICABLE TO GRINDER PUMP INSTALLATIONS)

1. The combination centrifugal pump impeller and grinder unit shall be attached to the common motor and pump shaft made of 416 stainless steel. The grinder unit shall be on the suction side of the pump impeller and discharge directly into the impeller inlet leaving no exposed shaft to permit packing of ground solids. The grinder shall consist of two stages. The cutting action of the second state shall be perpendicular to the plane of the first cut for better control of the particle size. The grinder shall be capable of grinding all materials found in normal domestic sewage, including plastics, rubber, sanitary napkins, disposable diapers, and wooden articles into a finely ground slurry with particle dimensions no greater than ¼ inch. Both stationary and rotating cutters shall be made of 440C stainless steel hardened to Rockwell 60C and ground to close tolerance.

2. The upper (axial) cutter and stationary cutter ring shall be reversible to provide new cutting edges to double life. The stationary cutter ring shall be a slip fit into the suction opening of the volute and held in place by three (3) 300 series stainless steel screws and a retaining ring. The lower (radial) cutter shall macerate the solids against the I.D. of the cutter ring and extrude them through the slots of the cutter ring. The upper (axial) cutter shall cut off the extrusions, as they emerge from the slots of the cutter ring to eliminate any roping effect which may occur in single stage cutting action. The upper (axial) cutter shall fit over the hub of the impeller and the lower (radial) cutter shall be slip fit and secured by means of peg and hole, and rotate simultaneously with the rotation of the shaft and impeller. The grinding mechanism shall be locked to the shaft by a 300 series stainless steel countersunk washer in conjunction with a 300 series stainless steel flat head cap screw threaded into the end of the shaft.

O. GENERAL GUIDE SPECIFICATIONS

1. Submittals

Submittal data shall be provided to show compliance with these specifications, plans or other specifications that will influence the proper operation of the pump(s). Standard submittal data for approval must consist of: a. Pump Performance Curves. b. Pump Outline Drawing. c. Station Drawing for Accessories. d. Electrical Motor Data. e. Control Drawing and Data. f. Access Frame Drawing. g. Typical Installation Guides. h. Technical Manuals. i. Parts List. j. Printed Warranty. k. Manufacturer's Equipment Storage Recommendations. l. Manufacturer's Standard Recommended Start-Up Report Form.

2. Testing

Testing performed upon each pump shall include the following inspections:

a. Impeller, motor rating and electrical connections shall be checked for compliance with this specification.

b. Prior to submergence, each pump shall be run dry to establish correct rotation.

c. Each pump shall be run submerged in water.

d. Motor and cable insulation shall be tested for moisture content or insulation defects.

Upon request, a written quality assurance record confirming the above testing/inspections shall be supplied with each pump at the time of shipment. Each pump (when specified) shall be tested in accordance with the latest test code of the Hydraulic Institute (HI) at the manufacturer to determine head vs. capacity and kilowatt draw required. Witness tests shall be available at the factory upon request.

3. Start-Up Service

The equipment manufacturer shall furnish the services of a qualified factory trained field service engineer for two 8-hour working day(s) at the site to inspect the installation and instruct the owner's personnel on the operation and maintenance of the pumping units. After the pumps have been completely installed and wired, the contractor shall have the manufacturer do the following:

a. Megger stator and power cables.
b. Check seal lubrication.
c. Check for proper rotation.
d. Check power supply voltage.
e. Measure motor operating load and no load current.
f. Check level control operation and sequence.

During this initial inspection, the manufacturer's service representative shall review recommended operation and maintenance procedures with the owner's personnel.

4. **Factory Service**

Factory-Approved service facilities with qualified factory-trained mechanics shall be available for prompt emergency and routine service.

5. **Guarantee**

A complete 1-year replacement warranty shall be provided for each pump.

6. **Manufacturers**

The pump, mechanical seals and motor shall be from the same manufacturer.

7. **Electrical Controls**

Electrical controls, sensing devices, pump control panels and related equipment for the pumping systems shall be furnished and installed as specified in Division 16.

P. NAMEPLATES

The pump shall have a Type 316 stainless steel plate permanently attached to the pump frame onto which the following information shall be impressed, engraved or embossed.

1. Manufacturer's Name
2. Manufacturer's Model Number
3. Manufacturer's Shop Order Number or Serial Number
4. Design Capacity, gpm
5. Design Head, ft
6. Design Speed, rpm
7. Motor horsepower

2.05 ACCESS FRAME AND COVER

The pump manufacturer shall furnish and the CONTRACTOR shall install an access frame and cover for each wet well. The cover shall be as manufactured by **BILCO** as shown on the drawings, made entirely of aluminum construction with stainless steel hardware and have fall protection. Covers for pump stations shall be H-20 traffic loading rated.

The covers shall be of non-skid, have flush or recessed lifting handles, safety handle to maintain cover in open locked position, and recess for padlocks. Integral with frame shall be upper guide bar holder and level sensor holder if required.

2.06 SPARE PARTS

Manufacturer shall supply one spare set of seals and bearings for each pair of pumps.

PART 3 - EXECUTION

3.01 PAINTING & LINING

The pumps and all other ferrous metal (except stainless steel) shall be factory primed and field finish painted. Interior walls of wet well shall be coated with POLIBRID® 705 Elastometric Polyurethane Coating or Tnemec's Perma-Shield® H2S Series 434 modified aliphatic amine epoxy mortar and applied according to manufacturer's specifications.

3.02 PREPARATION FOR SHIPMENT

Insofar as is practical, the equipment specified herein shall be factory assembled. The pump, parts, and assemblies that are of necessity shipped unassembled shall be packaged and tagged in such a manner that will protect the equipment from damage and facilitate the final assembly in the field. Generally, machined and unpainted parts shall be protected from damage by the elements with the application of strippable, protective coatings. Provide all lubricant required for initial lubrication.

3.03 INSTALLATION

The submersible pump shall be installed in strict accordance with the manufacturer's recommendations and as shown on the plans.

All strain from attached piping shall be eliminated from the pumps and any evidence of pump misalignment, noisy operation, or other signs of improper setting shall be corrected by the CONTRACTOR.

Install equipment such that they are properly aligned, plumb, and level. Flexible couplings shall not be considered to compensate for misalignment.

3.04 TESTS

A. FACTORY TEST

The pumps shall be factory tested prior to shipment. Factory test shall be a non-witnessed certified performance test according to manufacturer's specifications as stated above.

B. FIELD TESTING

Field testing shall demonstrate proper operation of the equipment and compliance with the drawings, these and the manufacturer's specifications stated above, and the *Standards of the Hydraulic Institute*. All equipment that fails any test shall be rejected, and complete retesting shall be required at the CONTRACTOR's expense after the CONTRACTOR makes corrections or modifications to equipment which previously has failed any test. All field tests shall be witnessed by the OWNER or ENGINEER.

Installation of the pumps shall be complete and the units shall be serviced, tested, adjusted and ready for use before the field tests are scheduled.

Written notice of the scheduled dates for the field tests shall be given to the OWNER at least 10 days prior to the field test dates. The notice shall include a written test schedule listing the tests, the test procedure, the criteria for a satisfactory test, and special measurement equipment to be employed.

Minor repairs and adjustments shall be made by the CONTRACTOR as required to achieve satisfactory performance of the pump drive units. If minor repairs or adjustments are made during the tests, additional testing shall be performed as required by the OWNER.

3.05 MANUFACTURER'S REPRESENTATIVE SERVICES

The manufacturer or his representative shall inspect the installation of the equipment prior to startup and shall make the necessary adjustments to the equipment for satisfactory operation. The manufacturer shall also be responsible for instructing the two personnel in the operation and maintenance of the equipment during two 8-hour days of training.

--END OF SECTION--

SECTION 11224

GRINDER

PART 1 - GENERAL

1.01 SCOPE

Contractor shall install the sewage grinder and the associated motor controller and control panel as shown on the plans or as recommended by the manufacturer and in compliance with all OSHA, local, state, and federal codes and regulations.

Each unit shall include at minimum a grinder, reducer, motor, and control panel.

1.02 QUALITY ASSURANCE

A. Grinder and motor controller shall meet the requirements of the following industry standards:

1. ISO9001 Certified Quality Management Systems
2. AISI A48-40B: Standard specification of gray iron castings
3. AISI 4140 Heat Treated Hexagon Steel
4. ASTM A536:60-40-18 Ductile Iron Castings
5. National Electrical Manufacturer's Association (NEMA) standards
6. National Electric Code (NEC)
7. Underwriters Laboratory (UL/cUL)
8. Canadian Standards Association (CSA)

1.03 SUBMITTALS

The CONTRACTOR shall submit information in accordance with Section 01300, SUBMITTALS, to substantiate compliance with this specification. In addition, the following specific information shall be provided.

A. SHOP DRAWINGS

Shop drawings showing fabrication, assembly, and installation drawings, together with detailed specifications and data covering performance and materials of construction, power drive assembly, parts, devices, and other accessories forming a part of the equipment furnished shall be submitted. Data and specifications for each pump specified under this section shall include, but shall not be limited to, the following:

1. Spare Parts Data: Prior to the date of commissioning the CONTRACTOR shall furnish spare parts data for each different item of materials and equipment

specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

B. OPERATION AND MAINTENANCE MANUALS

Operation and maintenance manuals shall be furnished for the equipment herein specified.

The manuals shall include:

1. Equipment descriptions
2. Operating instructions & drawings
3. Troubleshooting techniques
4. Recommended maintenance schedule & lubricants

1.04 SUPPLIER'S AND/OR MANUFACTURER'S SERVICES

The CONTRACTOR shall provide the following services of technical representatives at the jobsite relating to the item(s) specified in this section. The number of days and scope of services indicated are minimum requirements not including travel time. Time for travel and all associated expenses of the technical representative shall also be included at no additional cost to the OWNER.

Two labor days - Installation assistance, inspection and functional testing, plant startup services and performance testing, and training of two personnel.

Startup services and training of the two personnel shall be such times as requested by the _OWNER.

1.05 MEASUREMENT AND PAYMENT

Grinder shall not be measured or paid as a separate item, but shall be included as part of the Lump Sum Cost.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

Grinder(s) and motor controller(s) shall be supplied by Monoflo Inc, Houston TX. Grinder(s) shall be Model No. CA203AJT7B2/528 $\leq$ 400 gpm.

2.02 IDENTIFICATION

Each unit of equipment shall be identified with a corrosion resistant nameplate, securely affixed in a conspicuous place. Nameplate information shall include equipment model number, serial number, manufacturer's name and address.

2.03 SEWAGE GRINDERS

A. GENERAL

1. Number of sewage grinders shall be 1

2. The sewage grinders shall be two-shaft design and be capable of continuous operation, processing wet or dry. Single shaft devices utilizing a single rotating cutter bar with stationary cutters will not be acceptable.

3. Two-shaft design shall consist of two parallel shafts alternatively stacked with intermeshing cutters and spacers positioned on the shaft to form an offset or helical pattern. The two shafts shall counter-rotate with the driven shaft operating at approximately two-thirds (2/3) the speed of the drive shaft.

4. The entire machine assembly shall be finished with three coats of chlorinated rubber based surface coating to provide long term effective surface protection from the environment.

B. COMPONENTS

1. Grinder

   a. Each grinder shall include end housings, covers, shafts side rails, reducer, motor, cutters, spacers, bearings, and seals.

   b. Grinder end housing shall be cast of ASTM A48:40B gray iron and designed to protect the bushings while guiding particles directly into the cutter chamber. The cutter chamber shall be a nominal height of 12 inches and the opening to the chamber shall be a minimum of 8 1/2 inches in width.

   c. Top and bottom covers shall be cast iron ASTM A48:40B.

   d. Grinder drive and driven shafts shall be made of AISI 4140 Heat Treated Hexagon Steel with a minimum tensile strength rating of not less than 149,000 PSI. Each shaft diameter shall be a minimum of 2 inches.

2. High Flow Side Rails for channel grinders

   The inside profile of the side rail shall be concave to follow the radial arc of the cutters.The side rails shall be affixed to the grinder and maintain a clearance not to exceed 1/8 inch between the major diameter of the cutter and the concave arc of the side rail. Keeping this clearance directs larger particles toward the cutter to assure fine-ness of grind. Side rails shall have evenly spaced angled slots which cross the horizontal axis of at least two cutters to ensure the best grinding efficiency. Side rails shall be cast of ASTM A536:60-40-18 gray iron.

3. Side Rails for inline grinders

   The inside profile of the side rail shall be concave to follow the radial arc of the cutters. The side rails shall be affixed to the grinder and maintain a clearance not to exceed 1/8 inch between the major diameter of the cutter and the concave arc of the side rail. Keeping this clearance directs larger particles toward the cutter to assure fine-ness of grind. Side rails shall be cast of ASTM A536:60-40-18 gray iron.

4. Transition flanges and inspection covers for inline grinders shall be of ASTM A48:40B gray iron.

5. Reducer: The gear reducer shall be a grease filled planetary or helical type reducer with “Heavy Shock” load classification. The reduction ratio shall be of approximately 29:1. The high-speed shaft of the grinder shall be directly coupled with the reducer using a two piece coupling. Gear reducers shall not be used for hydraulic applications.

6. Motor: For TEXP submersible motor applications.

   a. The motor shall be TEXP submersible duty design, 3 HP, 4-pole, 208/230/460 volt, 60 Hz., 3-phase. Motor shall be hermetically sealed explosion proof by design, submersible type motor, rated for continuous in-air operation. Features include Class F insulation, 1.15 service factor at 40°C ambient temperature, high strength 416-SS shaft, high pressure lip seal, automatic reset N.C. series connected thermal overload protection, prelubricated shaft bearings designed for B-10 life 30,000 hours minimum, ASTM A48-83 CI 30 cast iron construction, epoxy sealed ‘non-wicking’ cable entry system and 25 feet standard of multi-conductor power and control cables.

7. Required running torque per horsepower:

    a. Continuously: 1000 in-lbs. minimum

    b. At momentary peak loads: 3300 in-lbs. minimum

8. Cutters and spacers

    a. The inside configuration of both cutters and spacers shall be hexagonal so as to fit the shafts with a total clearance not to exceed 0.010 inch across at least two pairs of flats to assure positive drive and increase the compressive strength of the spacers.

    b. Cutters and spacers shall be AISI 4140 Heat Treated Alloy Steel, surface ground for uniformity and through-hardened to a minimum of HRC 46-50.

    c. Standard cutters shall be designed to have 7 teeth on each cutter. The cutters shall be of CAM design.

    d. The cutter shall exert a minimum force of 450 lbs. per HP continuously and 1430 lbs. per HP at momentary load peaks at the tooth tip.

9. Bearings and Seals

    a. The cutter shaft's radial and axial loads shall be borne by four sealed oversized Conrad type ball bearings.

    b. The bearings shall be protected by a combination of a tortuous path device and end face mechanical seals. Face materials to be Tungsten Carbide to give the best life. Mechanical seals are to not require external flushing or lubrication of any type.

    c. The mechanical seals shall be rated at 90 PSI continuous duty.

    d. The bearings and seals shall be housed in a replacement cartridge that supports and aligns the bearings and seals, as well as protects the shafts and end housings.

    e. O-Rings shall be made of Buna-Nitrile elastomer.

2.04 CONTROL PANELS

Each grinder shall be supplied standard with a PLC mounted in a NEMA 4X FRP enclosure designed to provide all the necessary control functions. The panel shall include

forward and reverse contactors, breakers, thermal overloads, and a factory pre-programmed control unit. Field modification to the control unit is not necessary.
The programmed control unit shall measure motor power. In the event of an overload, the Controller shall cause the Muncher to reverse to attempt to clear the blockage. If the unit reverses 3 times within a 30-second period, the control unit will trip and indicate an alarm condition.

A. General

1. Control panel shall be Monoflo Standard MF-511

2. The control panel shall be equipped with a HAND-OFF-AUTO three-position selector switch. In OFF the grinder shall not run. In HAND the grinder shall run whenever manually started. In AUTO the grinder shall start and stop by controls from a remote location through dry contacts.

3. When a grinder jam occurs in either HAND or AUTO mode the controller shall stop the grinder, then reverse its rotation to clear the obstruction. If the jam is cleared, the controller shall return to normal operation. If the jam condition still exists, the controller shall go through two additional reversing cycles within 30 seconds (3 times total) before signalling a grinder overload condition. When a grinder overload condition occurs, the controller shall shut the grinder off and activate a relay and fail indication.

4. If the grinder is stopped due to a fail condition and a power failure occurs, the fail indicator shall reactivate when power is restored.

5. Controller reset shall be from local panel controls.

6. The control panel shall have indicator lights for POWER ON, RUN, and FAIL conditions.

7. The control panel shall provide overcurrent protection for the motor through an overload relay mounted directly off the started contactor.

8. The control panel shall be rated for 3 HP 220 volts, 3 phase, 60 Hz.

B. Components

1. Enclosure

    a. Enclosure shall be NEMA 4X, fabricated of fiberglass reinforced polyester resins and shall be suitable for wall mounting. Doors shall have hinges and corrosion resistant latches.

b. Enclosure shall house the control devices, relays, terminal blocks, and reversing motor starter.

2. Control Devices

a. Pilot devices shall be mounted on the enclosure front panel.

b. Indicators shall be integral transformer type with low voltage long life LED lights. Lights and the selector switch shall be heavy duty NEMA 4X type.

c. Two normally open status contacts shall be provided. One for a RUN signal and one for a FAIL signal. The contacts shall be rated at 2-Amp, 120-VAC resistive load.

3. Motor Starter

a. Starter shall be full voltage reversing type with 120-volt operating coils.

b. Forward and reverse contactors on the starter shall have both mechanical and electrical interlocks.

c. The overload relay shall be adjustable so that the range selected includes the FLA (full load amperage) rating and service factor.

PART 3 EXECUTION

3.01 FACTORY TEST

Each grinder and control panel shall be factory tested to ensure satisfactory operation.

3.02 INSTALLATION

Grinder and control panel shall be installed in accordance with the manufacturer's installation instructions and in compliance with all OSHA, local, state, and federal codes and regulations.

3.03 FIELD QUALITY CONTROL

Supplier shall provide the services of a factory-trained representative to check installation and to start-up each grinder. Factory representative shall have complete knowledge of proper installation, operation, and maintenance of equipment supplied. Representative shall inspect the final installation and supervise a start-up test of the equipment and provide 4 hours of training.

- END OF SECTION -

PART 1 - GENERAL

1.01 SCOPE

Contractor shall install the sewage grinder(s) and the associated motor controller(s) as shown on the plans or as recommended by the manufacturer and in compliance with all OSHA, local, state, and federal codes and regulations.

Each unit shall include at minimum a grinder, reducer, motor, and control panel.

1.02 QUALITY ASSURANCE

A. Grinder(s) and motor controller(s) shall meet the requirements of the following industry standards:

1. ISO9001 Certified Quality Management Systems
2. AISI A48-40B: Standard specification of gray iron castings
3. AISI 4140 Heat Treated Hexagon Steel
4. ASTM A536:60-40-18 Ductile Iron Castings
5. National Electrical Manufacturer's Association (NEMA) standards
6. National Electric Code (NEC)
7. Underwriters Laboratory (UL/cUL)
8. Canadian Standards Association (CSA)

1.03 SUBMITTALS

The CONTRACTOR shall submit information in accordance with Section 01300, SUBMITTALS, to substantiate compliance with this specification. In addition, the following specific information shall be provided.

A. SHOP DRAWINGS

Shop drawings showing fabrication, assembly, and installation drawings, together with detailed specifications and data covering performance and materials of construction, power drive assembly, parts, devices, and other accessories forming a part of the equipment furnished shall be submitted. Data and specifications for each pump specified under this section shall include, but shall not be limited to, the following:

1. Spare Parts Data: Prior to the date of commissioning the CONTRACTOR shall furnish spare parts data for each different item of materials and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

B. OPERATION AND MAINTENANCE MANUALS

Operation and maintenance manuals shall be furnished for the equipment herein specified.

The manuals shall include:

1. Equipment descriptions
2. Operating instructions & drawings
3. Troubleshooting techniques
4. Recommended maintenance schedule & lubricants

1.04 SUPPLIER'S AND/OR MANUFACTURER'S SERVICES

The CONTRACTOR shall provide the following services of technical representatives at the jobsite relating to the item(s) specified in this section. The number of days and scope of services indicated are minimum requirements not including travel time. Time for travel and all associated expenses of the technical representative shall also be included at no additional cost to the OWNER.

Two labor days - Installation assistance, inspection and functional testing, plant startup services and performance testing, and training of two personnel.

Startup services and training of the two personnel shall be such times as requested by the _OWNER.

1.05 MEASUREMENT AND PAYMENT

Grinder shall not be measured or paid as a separate item, but shall be included as part of the Lump Sum Cost.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

Grinder(s) and motor controller(s) shall be supplied by Monoflo Inc, Houston TX. Grinder(s) shall be Model No. CA203AJT7B2/528 ≤ 400 gpm.

2.02 IDENTIFICATION

Each unit of equipment shall be identified with a corrosion resistant nameplate, securely affixed in a conspicuous place. Nameplate information shall include equipment model number, serial number, manufacturer's name and address.

2.03 SEWAGE GRINDERS

A. GENERAL

1. Number of sewage grinders shall be 1

2. The sewage grinders shall be two-shaft design and be capable of continuous operation, processing wet or dry. Single shaft devices utilizing a single rotating cutter bar with stationary cutters will not be acceptable.

3. Two-shaft design shall consist of two parallel shafts alternatively stacked with intermeshing cutters and spacers positioned on the shaft to form an offset or helical pattern. The two shafts shall counter-rotate with the driven shaft operating at approximately two-thirds (2/3) the speed of the drive shaft.

4. The entire machine assembly shall be finished with three coats of chlorinated rubber based surface coating to provide long term effective surface protection from the environment.

B. COMPONENTS

1. Grinder

   a. Each grinder shall include end housings, covers, shafts side rails, reducer, motor, cutters, spacers, bearings, and seals.

   b. Grinder end housing shall be cast of ASTM A48:40B gray iron and designed to protect the bushings while guiding particles directly into the cutter chamber. The cutter chamber shall be a nominal height of 12 inches and the opening to the chamber shall be a minimum of 8 1/2 inches in width.

   c. Top and bottom covers shall be cast iron ASTM A48:40B.

   d. Grinder drive and driven shafts shall be made of AISI 4140 Heat Treated Hexagon Steel with a minimum tensile strength rating of not less than 149,000 PSI. Each shaft diameter shall be a minimum of 2 inches.

2. High Flow Side Rails for channel grinders

   The inside profile of the side rail shall be concave to follow the radial arc of the cutters.The side rails shall be affixed to the grinder and maintain a clearance not to exceed 1/8 inch between the major diameter of the cutter and the concave arc of the side rail. Keeping this clearance directs larger particles toward the cutter to assure fine-ness of grind. Side rails shall have evenly spaced angled slots which cross the horizontal axis of at least two cutters to ensure the best grinding efficiency. Side rails shall be cast of ASTM A536:60-40-18 gray iron.

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   The inside profile of the side rail shall be concave to follow the radial arc of the cutters. The side rails shall be affixed to the grinder and maintain a clearance not to exceed 1/8 inch between the major diameter of the cutter and the concave arc of the side rail. Keeping this clearance directs larger particles toward the cutter to assure fine-ness of grind. Side rails shall be cast of ASTM A536:60-40-18 gray iron.

4. Transition flanges and inspection covers for inline grinders shall be of ASTM A48:40B gray iron.

5. Reducer: The gear reducer shall be a grease filled planetary or helical type reducer with “Heavy Shock” load classification. The reduction ratio shall be of approximately 29:1. The high-speed shaft of the grinder shall be directly coupled with the reducer using a two piece coupling. Gear reducers shall not be used for hydraulic applications.

6. Motor: For TEXP submersible motor applications.

   a. The motor shall be TEXP submersible duty design, 3 HP, 4-pole, 208/230/460 volt, 60 Hz., 3-phase. Motor shall be hermetically sealed explosion proof by design, submersible type motor, rated for continuous in-air operation. Features include Class F insulation, 1.15 service factor at 40°C ambient temperature, high strength 416-SS shaft, high pressure lip seal, automatic reset N.C. series connected thermal overload protection, prelubricated shaft bearings designed for B-10 life 30,000 hours minimum, ASTM A48-83 CI 30 cast iron construction, epoxy sealed ‘non-wicking’ cable entry system and 25 feet standard of multi-conductor power and control cables.

7. Required running torque per horsepower:

    a. Continuously: 1000 in-lbs. minimum

    b. At momentary peak loads: 3300 in-lbs. minimum

8. Cutters and spacers

    a. The inside configuration of both cutters and spacers shall be hexagonal so as to fit the shafts with a total clearance not to exceed 0.010 inch across at least two pairs of flats to assure positive drive and increase the compressive strength of the spacers.

    b. Cutters and spacers shall be AISI 4140 Heat Treated Alloy Steel, surface ground for uniformity and through-hardened to a minimum of HRC 46-50.

    c. Standard cutters shall be designed to have 7 teeth on each cutter. The cutters shall be of CAM design.

    d. The cutter shall exert a minimum force of 450 lbs. per HP continuously and 1430 lbs. per HP at momentary load peaks at the tooth tip.

9. Bearings and Seals

    a. The cutter shaft's radial and axial loads shall be borne by four sealed oversized Conrad type ball bearings.

    b. The bearings shall be protected by a combination of a tortuous path device and end face mechanical seals. Face materials to be Tungsten Carbide to give the best life. Mechanical seals are to not require external flushing or lubrication of any type.

    c. The mechanical seals shall be rated at 90 PSI continuous duty.

    d. The bearings and seals shall be housed in a replacement cartridge that supports and aligns the bearings and seals, as well as protects the shafts and end housings.

    e. O-Rings shall be made of Buna-Nitrile elastomer.

2.04 CONTROL PANELS

Each grinder shall be supplied standard with a PLC mounted in a NEMA 4X FRP enclosure designed to provide all the necessary control functions. The panel shall include

forward and reverse contactors, breakers, thermal overloads, and a factory pre-programmed control unit. Field modification to the control unit is not necessary.
The programmed control unit shall measure motor power. In the event of an overload, the Controller shall cause the Muncher to reverse to attempt to clear the blockage. If the unit reverses 3 times within a 30-second period, the control unit will trip and indicate an alarm condition.

A. General

1. Control panel shall be Monoflo Standard MF-511

2. The control panel shall be equipped with a HAND-OFF-AUTO three-position selector switch. In OFF the grinder shall not run. In HAND the grinder shall run whenever manually started. In AUTO the grinder shall start and stop by controls from a remote location through dry contacts.

3. When a grinder jam occurs in either HAND or AUTO mode the controller shall stop the grinder, then reverse its rotation to clear the obstruction. If the jam is cleared, the controller shall return to normal operation. If the jam condition still exists, the controller shall go through two additional reversing cycles within 30 seconds (3 times total) before signalling a grinder overload condition. When a grinder overload condition occurs, the controller shall shut the grinder off and activate a relay and fail indication.

4. If the grinder is stopped due to a fail condition and a power failure occurs, the fail indicator shall reactivate when power is restored.

5. Controller reset shall be from local panel controls.

6. The control panel shall have indicator lights for POWER ON, RUN, and FAIL conditions.

7. The control panel shall provide overcurrent protection for the motor through an overload relay mounted directly off the started contactor.

8. The control panel shall be rated for 3 HP 220 volts, 3 phase, 60 Hz.

B. Components

1. Enclosure

    a. Enclosure shall be NEMA 4X, fabricated of fiberglass reinforced polyester resins and shall be suitable for wall mounting. Doors shall have hinges and corrosion resistant latches.

b. Enclosure shall house the control devices, relays, terminal blocks, and reversing motor starter.

2. Control Devices

a. Pilot devices shall be mounted on the enclosure front panel.

b. Indicators shall be integral transformer type with low voltage long life LED lights. Lights and the selector switch shall be heavy duty NEMA 4X type.

c. Two normally open status contacts shall be provided. One for a RUN signal and one for a FAIL signal. The contacts shall be rated at 2-Amp, 120-VAC resistive load.

3. Motor Starter

a. Starter shall be full voltage reversing type with 120-volt operating coils.

b. Forward and reverse contactors on the starter shall have both mechanical and electrical interlocks.

c. The overload relay shall be adjustable so that the range selected includes the FLA (full load amperage) rating and service factor.

PART 3 EXECUTION

3.01 FACTORY TEST

Each grinder and control panel shall be factory tested to ensure satisfactory operation.

3.02 INSTALLATION

Grinder and control panel shall be installed in accordance with the manufacturer's installation instructions and in compliance with all OSHA, local, state, and federal codes and regulations.

3.03 FIELD QUALITY CONTROL

Supplier shall provide the services of a factory-trained representative to check installation and to start-up each grinder. Factory representative shall have complete knowledge of proper installation, operation, and maintenance of equipment supplied. Representative shall inspect the final installation and supervise a start-up test of the equipment.

- END OF SECTION -

SECTION 13440

INSTRUMENTATION FOR PROCESS CONTROL: GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Basic requirements for complete instrumentation system for process control.

B. Related Sections include but are not necessarily limited to:
   1. Division 01000 - General Requirements.
   2. Division 11000 - Equipment.
   3. Division 16000 - Electrical.

1.02 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineer (ASME):
      a. B31.1, Power Piping.
      b. SEC II-A SA-182, Standard Specification for Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature.
      c. SEC II-A SA-479, Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels.
   2. American Society for Testing and Materials (ASTM):
      a. A106, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
      b. A234, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
      c. A269, Standard Specification for Seamless and Welded Austenitic Stainless steel Tubing for General Service.
      d. A276, Standard Specification for Stainless Steel Bars and Shapes.
      e. A479, Standard Specification for Stainless Steel Bars and Shapes for use in Boilers and other Pressure Vessels.
      f. B 16, Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines.
      g. B68, Standard Specification for Seamless Copper Tube, Bright

Annealed.

h. B75, Standard Specification for Seamless Copper Tube.

i. B 124, Standard Specification for Copper and Copper-Alloy Forging Rod, Bar, and Shapes.

j. B283, Standard Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed).

k. B453, Standard Specification for Copper-Zinc-Lead Alloy (Leaded-Brass) Rod.

3. Institute of Electrical and Electronic Engineers (IEEE):
   a. C62.41, IEEE Guide for Surge Voltages in Low-Voltage AC Power Circuits.
4. Instrument Society of America (ISA):
   a. S5.1, Instrumentation Symbols and Identification.
   b. S5.2, Binary Logic Diagrams for Process Operations.
   c. S5.3, Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer Systems.
   d. S5.4, Standard Instrument Loop Diagrams.
   e. S20, Standard Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.
   f. RP7.1-56, Pneumatic Control Circuit Pressure Test.
   g. National Institute of Standards and Technology (NIST).

B. Miscellaneous:
   1. Comply with electrical classifications and NEMA enclosures types shown on Drawings.

C. Qualifications:
   1. Instrumentation system integrator:
      a. Financial capability.
      b. Maintain a qualified technical staff.
      c. Have design capability.
      d. Have a physical plant and fabricating personnel.

1.03 DEFINITIONS

A. Calibrate: To standardize a device so that it provides a specified response to known inputs.

1.04 SYSTEM DESCRIPTION

A. Control System Requirements:
   1. This Specification Section 13440 provides the general requirements for the instrument and control system.
   2. The instrument and control system consists of all primary elements, transmitters, switches, indicators, panels, special power supplies, special or shielded cable, special grounding or isolation, auxiliaries, software, wiring, and other devices required to provide complete control of the well as specified in the Contract Documents.

B. Unless otherwise required for instrument compatibility, electric control signals shall be 4 to 20 milliampere and 24 V DC.

C. All signals shall be directly linearly proportional to measured variable unless specifically noted otherwise.

D. Single Instrumentation System Integrator:
   1. Furnish and coordinate instrumentation system through a single instrumentation integrator. The instrumentation system integrator shall be responsible for functional operations of all systems, performance of control system engineering, supervision of installation, final connections, calibrations, preparation of drawings and operation and maintenance manuals, startup, training, demonstration of substantial completion and all other aspects of the control system.
   2. Prior to shop drawing preparation, the instrumentation system integrator shall inspect the Owner's existing equipment and as-constructed electrical documentation so as to be able to fully coordinate the interface of new and existing instrumentation and controls. All costs associated with this work shall be incorporated into the original bid.
      a. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure, complete and compatible installation.
   3. The system integrator's scope of work shall include direct responsibility for work described in at least the following specification sections:
      a. 13441, 13446 and 13448.

1.05 SUBMITTALS

A. Shop Drawings:
   1. See Section 01300.
   2. Product technical data including:
      a. Acknowledgment that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Instrument component technical brochures.
      d. Instrument data sheets:
         (1) ISA 520 or approved equal.
         (2) Separate data sheet for each type of instrument.
      e. Materials of construction.
      f. Physical limits of components including temperature and pressure limits.
      g. Size and weight.
      h. Electrical power requirements and wiring diagrams.
      i. NEMA rating of housings.
   3. Loop diagrams per ISA S5.4.
      a. Each loop diagram on a separate sheet.
      b. Each sheet shall contain the following minimum information.
         (1) All loop devices clearly identified.
         (2) Identification of the loop and each loop component, including connections to such things as recorders and computers.
         (3) All interconnections with identifying numbers for:
            (a) Electrical cables.
            (b) Conductor pairs.
         (4) Identification of connections including:
            (a) Junction boxes.
            (b) Terminals.
            (c) Grounding systems.
         (5) Signal levels and ranges.
         (6) Device location.
         (7) Energy sources designating voltage, pressure, and other

applicable requirements.

(8) Enough process lines and equipment to clearly show the process side of the loop and provide clarity of control action. This includes:
  (a) What is being measured.
  (b) What is being controlled.
  (c) Other information required to complete the process loop.

(9) Reference to supplementary records and drawings to show inter-relation to other control loops.

(10) Controller action.

4. Process connected instrument installation details containing the following minimum information:
   a. Bill of materials providing as a minimum the following information:
      (1) Connection size.
      (2) Fitting size, material, and rating.
      (3) Instrument description.
   b. Minimum clearances.
   c. Required elevations and dimensions.
5. Comprehensive set of point-to-point wiring diagrams showing all interconnections between packaged systems or equipment control panels, motor starters, instrumentation and all other electrical equipment as required to depict a complete and functional electrical control system. Instrumentation wiring already shown on loop diagrams need not be included on point-to-point wiring diagrams.
   a. Diagrams shall provide the following minimum information:
      (1) Terminal block identification (includes terminals on remote equipment furnished by Others).
      (2) Wire identification number.
      (3) Wire size.
      (4) Wire type.
      (5) Wire color.
      (6) Wire shielding and insulation type.
      (7) Ground points.
      (8) Interconnection requirements to existing systems or

equipment furnished by Others.

b. Diagrams shall be provided on Drawings of sufficient size so as to minimize the number of drawings.
   (1) Maximum drawing size 24 x 36 IN.
   (2) Minimum drawing size: 11 x 17 IN.

6. Electrical schematic control diagrams. Diagrams shall include:
   a. Terminal identification.
   b. Unique identification of all control devices and contacts.
      (1) Utilize Owner's device identification numbers where applicable.
   c. Wire identification.
   d. Equipment identification.
   e. Indication of remote and local devices and wiring.
   f. Overcurrent protection indication.
   g. Voltage.
   h. All control logic.
7. Panel fabrication drawings.
8. Nameplate layout drawings.
9. Drawings, systems, and other elements are represented schematically in accordance with ISA S5.1 and S5.3. The nomenclature, tag numbers, equipment numbers, panel numbers, and related series identification contained in the Contract Documents shall be employed exclusively throughout submittals.
10. Provide circuit diagrams and certification with the shop drawing indicating how voltage transient protection requirements are met.
11. Warranties: Provide copies of warranties and list of factory authorized service agents.
12. Testing reports:
    a. Source quality control reports.

B. Operation and Maintenance Manuals:
   1. See Section 01700.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not remove shipping blocks, plugs, caps, and desiccant dryers installed to

protect the instrumentation during shipment until the instruments are installed and permanent connections are made.

PART 2 PRODUCTS

2.01 PERFORMANCE AND DESIGN REQUIREMENTS

A. System Operating Criteria:
   1. Stability: After controls have taken corrective action, as result of a change in the controlled variable or a change in setpoint, oscillation of final control element shall not exceed two cycles per minute or a magnitude of movement of 0.5 percent full travel.
   2. Response: Any change in setpoint or change in controlled variable shall produce a corresponding corrective change in position of final control element and become stabilized within 30 seconds.
   3. Agreement: Setpoint indication of controlled variable and measured indication of controlled variable shall agree within 3 percent of full scale over a 6: 1 operating range.
   4. Repeatability: For any repeated magnitude of control signal, from either an increasing or decreasing direction, the final control element shall take a repeated position within 0.5 percent of full travel regardless of force required to position final element.
   5. Sensitivity: Controls shall respond to setpoint deviations and measured variable deviations within 1.0 percent of full scale.
   6. Performance: All instruments and control devices shall perform in accordance with manufacturer's specifications.

2.02 ACCESSORIES

A. Provide instruments with manufacturer's identification nameplate showing:
   1. Manufacturer's model number.
   2. Manufacturer's serial number.
   3. Range.
      a. Utilize the same units of measurement as are utilized in the Contract Documents.

4. Power supply requirement.

2.03 PROGRAMMING SOFTWARE

A It is not required to deliver to the Owner at the conclusion of this project, licensed copies of RSLogix (PLC programming software) or RSView (Panelview programming software). Contractor shall include in his proposal, costs for the Owner or Engineer to make minor PLC programming or HMI page changes during the first year of operation. Include costs for one set of changes. Additional programming trips will be compensated on an hourly basis. Contractor shall deliver to the Owner at the conclusion of the project, and after any changes, copies of PLC and HMI programs in each O&M manual on a CD. Each CD shall have a label indicating "Great Salt Lake Marina/Saltair Wastewater System Improvements, 2006", revision designation, and the date the CD was delivered to the Owner. It is not necessary to list the files on the CD label.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install electrical components per Division 16.

C. Instrument Mounting:
   1. Mount all instruments where they will be accessible from fixed ladders, platforms, or grade.
   2. Mount all local indicating instruments with face forward toward the normal operating area, within reading distance, and in the line of sight.
   3. Mount instruments level, plumb, and support rigidly.
   4. Mount to provide:
      a. Protection from heat, shock, and vibrations.
      b. Accessibility for maintenance.
      c. Freedom from interference with piping, conduit and equipment.

D. Connect surge arresters to ground.

E. Panel-Mounted instruments:

1. Mount and wire so removal or replacement may be accomplished without interruption of service to adjacent devices.
2. Locate all devices mounted inside enclosures so terminals and adjustment devices are readily accessible without use of special tools and with terminal markings clearly visible.

3.02 FIELD QUALITY CONTROL

A. See Section 01650.

B. Instrumentation Calibration:
1. Verify that all instruments and control devices are calibrated to provide the performance required by the Contract Documents.
2. Calibrate all field-mounted instruments, other than local pressure and temperature gages, after the device is mounted in place to assure proper installed operation.
3. Calibrate in accordance with the manufacturer's specifications.
4. Calibrate each transmitter and gage across its specified range at 0, 25, 50, 75, and 100 percent. Check for both increasing and decreasing input signals to detect hysteresis.
5. Replace any instrument which cannot be properly adjusted.

C. Loop checkout requirements are as follows:
1. Check control signal generation, transmission, reception and response for all control loops under simulated operating conditions by imposing a signal on the loop at the instrument connections. Use actual signals where available. Closely observe controllers, alarm and trip units, and other control components. Make corrections as required. Following any corrections, retest the loop as before.
2. In addition to any other as-recorded documents, record all setpoint and calibration changes on all affected Contract Documents and turn over to the Owner.

D. Provide verification of system assembly, power, ground, and I/O tests.

E. Verify existence and measure adequacy of all grounds required for

instrumentation and controls.

PART 4 - METHOD MEASUREMENT AND BASIS PAYMENT

4.01 BASIS OF MEASUREMENT

A. Work covered by this specification shall include all plant, labor and materials necessary to furnish and install the instrumentation and process control system as specified in this section as well as Sections 13441, 13446 and 13448, and as shown on the drawings. Also included in this section is control wiring and conduit between the devices that are specified in these sections. Payment for items identified in Sections 15010 and 16050 will not be paid for under this section.

4.02 BASIS OF PAYMENT

A. Work as completed and measured as provided in Part 4.01.A shall be paid for at the bid lump sum price for Instrumentation for Process Control.

B. Payment shall constitute full compensation for work necessary to complete the installation as provided herein.

END OF SECTION

SECTION 13441

CONTROL LOOP DESCRIPTIONS

PART 1 - GENERAL

1. 01 SUMMARY

A. Section Includes:
   1. Instrumentation control loops.

B. Related Sections include but are not necessarily limited to:
   1. Division 01000 - General Requirements.
   2. Section 13440 - Instrumentation for Process Control: General Requirements.

1. 02 QUALITY ASSURANCE

A. See Section 13440.

1. 03 SYSTEM DESCRIPTION

A. Functional descriptions contained are for informational purposes intended to supplement and complement instrumentation control schematics and other details when included in drawings and specifications. Provide instrumentation hardware and software as necessary to perform control functions specified herein and shown on the drawings. Ensure coordination of instrumentation manufacturer with other work to ensure that necessary wiring, conduits, contacts, relays, converters, and incidentals are provided in order to transmit, receive, and control necessary signals to other control elements, to control panels, and to receiving stations.

B. The control loop descriptions are not intended to be an inclusive listing of all elements and appurtenances required to execute loop functions and shall not be considered equal to a bill of materials.

C. The System shall consist of three Allen-Bradley Micrologix 1100 Programmable

Logic Controllers (PLC's) a three locations (Marina Restroom: CP-A, Marina Maintenance Building: CP-B and Saltair: CP-C), networked together via a 900 MHz spread spectrum radio Ethernet radios. Each control panel shall have a Human Machine Interface (HMI) which shall be programmed for the operators to observe all I/O and station parameters within the network.

The PLC, control panel enclosure and all interior components, HMI displays, arrangement, installation, programming and testing shall be by the contractor

1. 04 SUBMITTALS

A. See Section 13440.

B. Secure from instrumentation system integrator and include with submittal control loop descriptions for each loop in system. Ensure that tag numbers cross reference with loop diagrams and tag numbers shown on instrument specification forms. Describe each element and include appropriate tag number. When additional elements are necessary, use and assign tag number not in conflict with others and in accordance with ISA procedures.

C. Operation and Maintenance Manuals:
1. See Section 01300 – Contractor Submittals.

D. Provide a color print of each HMI screen during the submittal process. The Contractor shall make all Engineer and owner requested changes, until HMI screens are approved by both parties. HMI screens shall not be implemented on the project, until a written approved is received from both parties.

PART 2 - PRODUCTS. (NOT APPLICABLE TO THIS SECTION)

PART 3 - EXECUTION

3. 01 GENERAL DESCRIPTION

A. The pump control system shall be configured for either manual or automatic operation with or without an operator in attendance. Selections for the type of operation shall be made at the Human Machine Interface panel (HMI) at Control Panel A (CP-A) and at a hand switches, located at each motor starter enclosure. Alarms, indications and hand switches shall be programmed at the HMI display.
   1. The pumps shall be manually controlled from each individual motor starter enclosure. Automatic controls shall be located in Control Panel (CP-X) for both local and remote operation. Control Panes (CP-X) shall be Programmable Logic Controller (PLC) based. It shall be located at each site. The Pump system shall include PLC Programming, HMI Screens, etc.
   2. The Water Level monitors the water levels in the wet well Water level indicators and controls shall be located in the Control Panels (CP-X).
   3. The Alarm Reset shall provide HMI access to reset the Wet Well Level and Overload alarms.

B. Functional Requirements
   1. The Control System shall provide all of the functions described hereinafter for each system. Major equipment items are specified for each loop; however, all items of equipment, whether indicated or not, that are necessary to effect the required performance, shall be provided.

C. PLC/HMI Based Systems General Requirements
   1. The Human Machine Interface (HMI) display shall be programmed with multiple screen pages to allow the operators to monitor and control all PLC based controls. The HMI shall be organized with a main menu, and sub-menu's as required to logically select systems and motors.
   2. Provide a main menu selection page with provisions to select a System Summary page.
   3. Provide a System Summary Page for each site with motor status indication. Motor status indication shall show pump availability. The System Summary Pages shall include provisions to select individual motor pages. Individual motor display requirements are listed below.
   4. Provide a Motor Elapsed Time Summary page. This page shall display the elapsed running time for all PLC controlled motors.

5. Provide an Alarm Summary Page with indication for all alarm status. No alarm reset pushbutton is required on this page. Alarm shall be acknowledged and reset on the specific motor/controller page.
6. For troubleshooting purposes, provide a PLC Input/Output summary page indicating the PLC status of all Inputs and Outputs.
7. Pumping System Summary Page. Show the running and available status of each pump, wet well levels and level setpoints.
8. Provide other pages as necessary to navigate the PLC control system. Pumping System Summary page. Show the running and available status of each pump, and wet well level status.

D. Motor Control:

1. Field Switches - Submersible Pumps: Each submersible motor shall be supplied with a duplex motor starting control panel, and each pump shall have a HAND-OFF-AUTO selector switch.
   a. When HAND is selected, the motor shall operate.
   b. When OFF is selected, the motor shall stop.
   c. When AUTO is selected, motor control shall be determined by the HMI/PLC.

2. Field Switches - Grinder: Grinder motor shall be supplied with a separate control panel and pre-programmed PLC. The Grinder pump shall have a HAND-OFF-AUTO selector switch.
   a. When HAND is selected, the motor shall operate.
   b. When OFF is selected, the motor shall stop.
   c. When AUTO is selected, motor control shall be determined by the PLC.

3. PLC/HMI Functions:
   a. The HMI shall have an individual page for each lift station motor. This page shall include the following:
      i. HAND-OFF-AUTO selector switch.
      ii. LEAD-LAG-ALTERNATE (L-L-A) pump selector switch.
      iii. Pump running status.
      iv. Pump “READY TO START” indicator light.
      v. Motor elapsed time counter indicator.
      vi. PLC control output status indication.

4. Operation:

a. When in HAND, the motor shall operate.
b. When in OFF, the motor shall stop.
c. When in AUTO, PLC logic shall control the pump.
d. The pump READY TO START indicating light shall be on when:
   i. H-O-A switch: AUTO
   ii. Pump seal fail or thermal alarm: OK

3. 02 MARINA RESTROOM LIFT STATION

A. The level transducer shall continuously monitor the water level in the wet well. When the transducer signal is greater then 4 mA and less than 20 mA the HMI shall indicate OK and display the water level as a dynamic vertical bar and numerically (feet-inches).

B. Provide a LEAD-LAG-ALTERNATE switch for Pumps 101 and 102. If LEAD is selected, Pump 102 shall be automatically designated LAG. If LAG is selected, Pump 102 shall be automatically designated LEAD. If ALTERNATE is selected, the LEAD pump shall be determined to be the pump with the least time on the elapsed time counter. Provide LEAD or LAG pump indication on each pump page.

C. If the wet well level exceeds a pre-determined, operator-adjustable setpoint the PLC shall start the LEAD pump(s). The value of the setpoint shall be indicated on the HMI page.

D. If the wet well level exceeds a pre-determined, operator-adjustable setpoint the PLC shall start the LAG pump. The value of the setpoint shall be indicated on the HMI page.

E. When the level lowers to a pre-determined, operator-adjustable setpoint the PLC shall stop both pumps. The value of the setpoint shall be indicated on the HMI page.

F. If the high level float switch is activated, all available (pumps hand-off-auto switch is in auto) pumps shall run for a pre-determined length of time, then stop. This process shall be repeated each time the high level float switch is activated. See 3.05 – System Alarms/ status for additional actions by the PLC under alarm conditions.

3. 03 MARIN MAINTENANCE BUILDING LIFT STATION

A. The level transducer shall continuously monitor the water level in the wet well. When the transducer signal is greater then 4 mA and less than 20 mA the HMI shall indicate OK and display the water level as a dynamic vertical bar and numerically (feet-inches).

B. Provide a LEAD-LAG-ALTERNATE switch for Pump 201. If LEAD is selected, Pump 202 shall be automatically designated LAG. If LAG is selected, Pump 202 shall be automatically designated LEAD. If ALTERNATE is selected, the LEAD pump shall be determined to be the pump with the least time on the elapsed time counter. Provide LEAD or LAG pump indication on each pump page.

C. If the wet well level exceeds a pre-determined, operator-adjustable setpoint the PLC shall start the LEAD pump(s). The value of the setpoint shall be indicated on the HMI page.

D. If the wet well level exceeds a pre-determined, operator-adjustable setpoint the PLC shall start the LAG pump. The value of the setpoint shall be indicated on the HMI page.

E. When the level lowers to a pre-determined, operator-adjustable setpoint the PLC shall stop both pumps. The value of the setpoint shall be indicated on the HMI page.

F. If the high level float switch is activated, all available (pumps hand-off-auto switch is in auto) pumps shall run for a pre-determined length of time then stop. This process shall be repeated each time the high level float switch is activated. See 3.05 – System Alarms/ status for additional actions by the PLC under alarm conditions.

3. 04 SALTAIR LIFT STATION

A. The level transducers shall continuously monitor the water level in the wet well and the grinder channel. When the transducer signals are greater then 4 mA and less than 20 mA the HMI shall indicate OK and display the water level as a dynamic vertical bar and numerically (feet-inches).

B. Provide a LEAD-LAG-ALTERNATE switch for Pump 301. If LEAD is selected, Pump 302 shall be automatically designated LAG. If LAG is selected, Pump 302 shall be automatically designated LEAD. If ALTERNATE is selected, the LEAD pump shall be determined to be the pump with the least time on the elapsed time counter. Provide LEAD or LAG pump indication on each pump page.

C. If the wet well level exceeds a pre-determined, operator-adjustable setpoint the PLC shall start the LEAD pump(s). The value of the setpoint shall be indicated on the HMI page.

D. If the wet well level exceeds a pre-determined, operator-adjustable setpoint the PLC shall start the LAG pump. The value of the setpoint shall be indicated on the HMI page.

E. When the wet well level lowers to a pre-determined, operator-adjustable setpoint the PLC shall stop both pumps. The value of the setpoint shall be indicated on the HMI page.

F. If the wet well high level float switch is activated, all available (pumps hand-off-auto switch is in auto) pumps shall run for a pre-determined length of time, then stop. This process shall be repeated each time the high level float switch is activated. See 3.05 – System Alarms/ status for additional actions by the PLC under alarm conditions.

G. See specifications section 11223 for grinder control information.

3. 05 SYSTEM ALARMS/STATUS

A. The control system shall provide a System Status OK or TROUBLE alarm.
   1. OK status indicates:
      a. Network communications: OK.
      b. Marina Restroom station:
         1. Utility power supply: OK
         2. Wet well high level: OK
         3. Pump 101 or Pump 102: READY TO START
         4. Wet well level transducer: OK
         5. Wet well high level float: OK
      c. Marina Maintenance Bldg. station:
         1. Utility power: OK

2. Wet well high level: OK
3. Pump 201 or Pump 202: READY TO START
4. Wet well level transducer: OK
5. Wet well high level float: OK

d. Saltair station:
1. Utility power: OK
2. Wet well high level: OK
3. Pump 301 or Pump 302: READY TO START
4. Wet well level transducer: OK
5. Wet well high level float: OK
6. Grinder channel level float: OK

2. TROUBLE status shall indicate that any of the above conditions are false. Provide a HMI page indicating the status of each condition. Trouble status shall maintain active until reset by an acknowledgement the alarming condition.

B. Network Communications Status:

1. The control system shall continuously monitor communications integrity using a fail-safe watch-dog timer. CP-B shall be designated as the master, and CP-A and CP-C shall be slave nodes. The master node shall periodically test radio communications integrity and PLC performance to each slave node with each successful test resetting a watch-dog timer. The frequency (ie. "XX" minutes between tests) of the tests shall be operator programmable at the HMI. Should a network slave node fail to respond to the master or if the node PLC does is not successfully scanning, a comm failed indication shall be displayed on the CP-B HMI, the alarm light at the Saltair station shall light and the phone dialer alarm shall be initiated. Alarm light shall maintain active until reset by an acknowledgement of the alarming condition.

C. Utility Power Status:

1. The control system shall continuously monitor both utility and UPS/TVSS power status at each control panel and provide a station OK signal to the master node. Should utility or UPS/TVSS power fail, the node shall provide a TROUBLE signal to the master node. Note: Utility power is defined as when the control panel is energized by either site generated power (permanent or portable generator) or Utility Company provided power.

D. Wet well high level alarms:

1. The control system shall monitor high level float switches in each wet well. Should a switch indicate high level, the pump(s) that discharge to that wet well shall be immediately stopped, and the alarm indicated on the HMI on both a common alarm page and on each discharge pump screen. A station with a high level alarm shall provide a TROUBLE signal to the master node, indicating that the pump station is not available. The high level alarm shall automatically start both pumps, and they shall operate for a pre-determined, operator adjustable time period and then automatically stop. The alarm light at the Saltair station shall light and the phone dialer alarm shall be initiated. Alarm light shall maintain active until reset by an acknowledgement of the alarming condition.

E. Pump H-O-A Status:

1. The control system shall monitor the H-O-A switch for each pump at each station. If both switches are in either HAND or OFF (neither in AUTO), the node shall provide a TROUBLE signal to the master node, indicating that the pump station is not available.

F. Wet Well Level Transducer status:

1. The local PLC shall test the 4-20 mA DC wet well analog signal. The station shall provide a TROUBLE signal to the master node indicating that the level transducer has failed if the analog signal is less than 4 mA or greater than 20 mA. The alarm light at the Saltair station shall light and the phone dialer alarm shall be initiated. Alarm light shall maintain active until reset by an acknowledgement of the alarming condition.

G. Grinder Trouble Alarm

1. The local PLC shall monitor both the trouble alarm contacts in the grinder control panel and the grinder channel high level float switch. Grinder trouble alarms shall not affect System Status alarm, but the alarm shall be indicated on the HMI alarm summary page as well as lighting the alarm light at the Saltair station. Alarm light shall maintain active until reset by an acknowledgement of the alarming condition.

PART 4 - MEASUREMENT AND PAYMENT

4. 01 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. This will be paid for under the Total Lump Sum Cost. No separate measurement of payment will be made under this section.

END OF SECTION

SECTION 13446

CONTROL AUXILIARIES

PART 1 - GENERAL

1. 01 SUMMARY

A. Section Includes:
   1. Selector switches.
   2. Indicating lights.
   3. Relays.
   4. Terminal blocks.

B. Related Sections include but are not necessarily limited to:
   1. Division 01000 - General Requirements.
   2. Section 13440 - Instrumentation for Process Control: General Requirements.
   3. Section 16100 – Electrical Equipment

1. 02 QUALITY ASSURANCE

A. Referenced Standards:
   1. Instrument Society of America (ISA):
   2. National Electrical Manufacturers Association (NEMA):
      a. ICS 2, Standards for Industrial Control Devices, Controllers and Assemblies.
      b. ICS 6, Enclosures for Industrial Controls and Systems.

B. Miscellaneous:
   1. Assure units comply with electrical area classifications and NEMA enclosure type shown on Drawings.

1. 03 SUBMITTALS

A. Shop Drawings:
   1. See Section 13440.

B. Operation and Maintenance Manuals:
   1. See Section 01700.

PART 2 - PRODUCTS

2. 01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers as listed in the articles describing the devices are acceptable.

B. Submit requests for substitution in accordance with Division 1.

2. 02 SELECTOR SWITCHES

A. Acceptable Manufacturers:
1. Allen-Bradley.
2. Cutler Hammer.
3. Square D.

B. Design and Fabrication:
1. NEMA 12: Heavy-duty type, NEMA 4X: Corrosion resistant.
2. Rotary cam units conforming to NEMA ICS 2-216.22.
3. Supply switches having number of positioners required with contact blocks to fulfill functions shown and specified.
4. Maintained contact type.
5. Black lever type operators.
6. Full size 30 mm.
7. Designed with cam and contact block with approximate area of 2 IN SQ.
8. Legend plate marked per Contract Documents.

2. 03 INDICATING LIGHTS

A. Acceptable Manufacturers:
1. Allen-Bradley.
2. Cutler Hammer.
3. Square D.

B. Design and Fabrication:
1. NEMA 12: Heavy-duty type, NEMA 4X: Corrosion resistant.
2. Type allowing replacement of bulb without removal from control panel.
3. Lights in 120 V AC control circuits shall be transformer type push-to-test.
    a. Color code lights as follows:
        (1) Red: OFF.
        (2) Green: ON.

b. Legend plate engraved for each light.

2. 04 RELAYS

A. Acceptable manufacturers:
1. Allen Bradley.
2. Cutler Hammer.
3. IDEC.
4. Square D.

B. Design and Fabrication:
1. Provide momentary or latching electromechanical relays as shown on the schematics and as required to perform the functions specified.
2. Provide heavy-duty plug-in industrial relays with continuous duty coils in voltages specified. Provide integral "energized" indicating light.
3. Provide multiple 10 amp double throw contacts as required for the functions specified.
4. Provide mating sockets and mounting hardware as required.

2. 05 TERMINAL BLOCKS

A. Acceptable manufacturers:
1. Square D.
2. Buchanan
3. Or equal.

B. Terminal blocks shall be of the size required for conductors therein and a minimum of 50 percent spares shall be provided in each terminal box.

2. 06 ENCLOSURE HEATER

A. Acceptable Manufacturers:
1. Hoffman
2. Approved Equals

B. Provide a keep warm condensate heater with built-in thermostat and fan. Heater shall appropriately sized based on surface area of control panel enclosure.

2. 07 HMI SCREEN

A. Allen Bradley, Paenlview Plus, 32711P-T6C-20A, No equals accepted.

2. 08 RADIO

A. 900 MHz spread spectrum radio

B. Freewave, #FGR-115RE or approved equal

C. Provide a manufacturer recommended cable from radio to antenna

2. 09 ETHERNET SWITCH

A. 4 port 10/100 Ethernet switch

B. Provide RJ-45 cables, as required to connect the PLC, HMI and radio to Ethernet switch.

2. 010 Power Supply Units

A. Provide regulated PLC rack power units:
   1. Designed to operate with PLC control system and shall provide power to:
      a. All components of PLC control system.
      b. Other devices as indicated on Drawings or Specifications.
   2. Capable of supplying PLC control system when all of the specified spare capacity is utilized.
   3. Each power supply shall be sized such that it will carry no more than 75 percent of capacity under normal loads.

B. Input voltage to PLC power supply shall be 120 VAC.

C. If the PLC control system is field expandable beyond the specified spare capacity, and if such expansion requires power supply modification, note such requirements in the submittals and allow room for power supply modification in the PLC control system enclosure.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

PART4 - MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. This work is subsidiary and part of the instrumentation for process control system and will be paid for under that bid item. No separate measurement of payment will be made under this section.

END OF SECTION

SECTION 13448

CONTROL PANELS

PART 1 - GENERAL

1. 01 SUMMARY

A. Section Includes:
   1. Control panels.

B. Related Sections include but are not necessarily limited to:
   1. Division 01000 - General Requirements.
   2. Section 13440 - Instrumentation for Process Control: General Requirements.

1. 02 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society for Testing and Materials (ASTM):
      a. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
   2. Joint Industrial Council (HC):
      a. EMP-l, Mass Production Equipment.
   3. National Electrical Manufacturers Association (NEMA):
      a. ICS 4, Terminal Blocks for Industrial Use.
      b. ICS 6, Enclosures for Industrial Controls and Systems.
      c. 250, Enclosures for Electrical Equipment (1000 V Maximum).
   4. National Fire Protection Association (NFPA):
      a. National Electric Code (NEC).

B. Miscellaneous:
   1. Prior to placement of conduit feeds, assure approved control panel layouts available.
   2. Assure completely matching color tones for any individual color specified.
   3. Provide panel with the required NEMA rating per NEMA Publication No. 250 to meet classifications shown on drawings or specifications.

1. 03 SUBMITTALS

A. Shop Drawings:

1. See Section 13440.
2. Scaled panel face and subpanel face instrument and nameplate layout drawings.
3. Panel and subpanel materials of construction.
4. Panel and subpanel dimensions and weights.
5. Panel access openings.
6. Conduit and wiring access locations.
7. Internal wiring and terminal block drawings.
8. Nameplate text.

B. Operation and Maintenance Manuals:
1. See Section 01700.

PART 2 - PRODUCTS

2. 01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Consoles and standard NEMA enclosures:
a. Hoffman Engineering.
b. Hammond
c. Approved equal.

2. 02 MATERIALS

A. Front Panel, Subpanel or Front Door: Steel unless otherwise shown on Drawings.

B. Frame and Bottom Angles: Steel.

C. Top, Sides, Back, Sides, and Back Door: Steel unless otherwise shown on Drawings.

D. Hinges: Stainless steel.

E. Nameplates: Phenolic.

2. 03 ACCESSORIES

A. Panel Nameplates and Identification:
1. Identify each item on the control panel with rectangular nameplates.

2. Provide nameplates with black letters on white background.
3. Minimum letter height is 3/16 IN for instrument description and 1/8 IN height for instrument tag number.
4. For all panels which have a panel identification number, provide 2 IN high white nameplate with black, 1/2 IN high lettering with panel identification number.

2. 04 FABRICATION

A. General:
1. Fabricate panels with instrument arrangements as shown on the Drawings.
2. Prime control panels with rust inhibitive shop applied primer and paint with two coats of ANSI 61 gray.
3. Finish interior of panel with epoxy glass white.
4. Control panels located outside shall have an internal swing out panel. The selector switches indicator lights and HMI display shall be installed on this panel. No devices shall be installed on the exterior door of panel.
5. Provide control panel which meets the following requirements:
   a. Panel depth per JIC EMP-1-1967, E7.1.4.
   b. Door opening per JIC EMP-1-1967, E7.1.5.
   c. Data pocket per JIC EMP-1-1967, E7.1.6.
   d. Rigidity per JIC EMP-1-1967, E7.1.7.
   e. Door alignment and reinforcement per JIC EMP-1-1967, E7.1.8.
   f. Panel holes and openings per JIC EMP-1-1967, E7.3.2, E7.3.3, and E7.3.4.
   g. Doors per JIC EMP-1-1967, E7.5.
   h. Clear panel mounting space per JIC EMP-1-1967, E8.2.9.
   i. Panel mounted control device location per JIC EMP-1-1967, E8.3.4.
   j. Clearances in enclosures per JIC EMP-1-1967, E8.4.

B. Wall Mounted Panels:
1. Minimum construction thicknesses:
   a. Front panel, subpanel or door with cutouts:
      (1) Width or height not exceeding 42 IN: 0.093 IN.
      (2) Width or height exceeding 42 IN: 0.123 IN.
   b. Side, top, back and doors without cutouts: minimum thickness per NEMA ICS 6, Tables 3-8,9.
2. Seams continuously welded and ground smooth.
3. Body stiffeners for extra rigidity if either height or width exceeds 28 IN.
4. Rolled lip around all sides of enclosure door opening.
5. Gasketed dust tight.

6. Three-point latching mechanism operated by oil tight key-locking handle.
7. Key doors alike.
8. Continuous heavy GA hinge pin on doors.
   a. Hinges rated for 1.5 times door plus instrument weight.
9. After cutouts have been made, finish opening edges to smooth and true surface condition.
10. Front full opening door.
11. Brackets for wall mounting.

C. Panel Wiring and Piping:
1. Factory pipe and wire panels to identified terminal blocks equipped with screw type lugs.
2. Install all wiring without splicing in factory in raceways:
   a. Size raceways per the requirements of NEC Article 312.
   b. Raceways shall have removable covers.
3. Wire bending space shall be in accordance with Tables 307B, C in NEMA ICS 6.
4. Keep AC power lines separate from low-level DC lines, I/O power supply cables, and all I/O rack interconnect cables.
5. Keep AC signal wires separate from DC signal wires.
6. When I/O wiring must cross AC power wiring, it shall only do so at right angles.
7. Arrange circuits on terminal blocks plus any spare conductors on adjacent terminals.
8. Provide necessary power supplies for control equipment.
9. Equip each panel with a main thermal magnetic circuit breaker. Limit load to maximum of 80 percent of circuit breaker rating.
10. Provide all necessary stabilizing voltage transformers, balancing potentiometers and rectifiers as necessary for specific instrument requirements.
11. Assure each panel mounted device is bonded or otherwise grounded to panel or panel grounding system by means of locknuts or pressure mounting methods.
   a. Equip panel with grounding terminals.
12. Arrange wiring with sufficient clearance for all leads.
13. Wiring to subpanels or rotary switches shall be individually bundled and installed with a "flexible loop" of sufficient length to permit the component to be removed from panel for maintenance without disconnecting wiring.
14. Identify all wires with plastic sleeve type wire markers at each end. Markers shall:
   a. Identify circuit numbers.

b. Identify function and polarity.

15. Provide all wiring according to color code as follows:

COLOR OF INSULATION	120V, 60 HZ SERVICE	LOW VOLTAGE DC SERVICE
Black	Phase Conductor	Positive (analog transmission)
Red		Positive and negative (control, power)
White	Neutral	Negative (transmission)
Green	Ground	-

16. Termination requirements:
    a. Terminal block markings, mechanical characteristics and electrical characteristics shall be in accordance with NEMA ICS 4.
    b. Terminals shall facilitate wire sizes as follows:
        (1) 120 VAC applications: Wire size 12 AWG and smaller.
        (2) Other: Wire size 14 AWG and smaller.
    c. Provide terminal blocks with continuous marking strip.
    d. Tag each I/O terminal to indicate tag number of the connected device.
    e. Provide terminals for individual termination of each signal shield.
    f. Provide 20 percent excess terminals for future expansion.

D. Panel Power. Provide an electrical outlet in each power panel.

2. 05 MAINTENANCE MATERIALS

A. Extra Materials:
1. Replacement Bulbs. Provide minimum 25 percent or 25 bulbs, whichever is greater, for replacement indicating light bulbs for each type of indicator furnished in this Project.

2. 06 SCHEDULE OF PANELS

A. Provide enclosures as follows:

TAG NO.	SERVICE	ENCLOSURE	MATERIAL	SUPPLIER*
CP-A	General	NEMA 12	Steel	I
CP-B	General	NEMA 12	Steel	I
CP-C	General	NEMA 4X	Fiberglass	I
MS-A	General	NEMA 12	Steel	P

MS-B	Existing			R
MS-C	General	NEMA 4X	Fiberglass	P

*I = Instrumentation System Integrator (ISI)
P = Pump Supplier
R = Existing panel to be retrofit by ISI as required

PART 3 - EXECUTION

3. 01 INSTALLATION

A. Anchor NEMA panels rigidly into wall system or mounting surface with approved anchorage devices.

B. Permanently attached phenolic nameplates with screws.

PART 4 - MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. This work is subsidiary and part of the instrumentation for process control system and will be paid for under that bid item. No separate measurement of payment will be made under this section.

END OF SECTION

DIVISION 15

MECHANICAL

SECTION 15067

HIGH DENSITY POLYETHYLENE PIPE

PART 1 GENERAL

1.01 DESCRIPTION

A. This section covers furnishing and installation of high density polyethylene (HDPE) pipe that will be used for sliplining the existing PVC piping system as shown on the drawings and specified herein.

1.02 REFERENCES

A. The latest edition of the following publications form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)

ASTM D 1248	Standard Specifications for Polyethylene Plastics, Molding & Extrusion Materials.
ASTM D 2321	Underground Installation of Flexible Thermoplastic Sewer Pipe.
ASTM D 2837	Standard Method for Obtaining Design Basis for Thermoplastic Pipe Materials.
ASTM D 3261	Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D 3350	Standard Specification for Polyethylene Plastic Pipe and Fittings Materials.

AMERICAN WATER WORKS ASSOCIATION

AWWA C 906 Polyethylene (PE) Pressure Pipe and Fittings, 4 In. through 63 In., for Water Distribution

PHILLIPS PETROLEUM DRISCOPIPE

Technical Note No. 35, "Hydrostatic Testing of HDPE Pressure Pipelines."

1.03 SUBMITTALS

A. The following shall be submitted:

1. Certified copies of test reports demonstrating conformance to applicable pipe specifications, before pipe is installed.

1.04 MEASUREMENT AND PAYMENT

A. High Density Polyethylene pipe shall not be measured or paid as a separate item, but shall be included as part of the Lump Sum Cost.

PART 2 PRODUCTS

2.01 POLYETHYLENE PIPE

A. The piping material and fittings shall conform to AWWA C-906 and shall be made from PE 2406, PE 3406, or PE 3408 as referenced in ASTM D 3350 and ASTM 2837. The high density polyethylene pipe material shall have a manufacturer's recommended design stress rating of 800 psi based on a material with a 1600 psi design basis determined in accordance with ASTM D 2837. All high density polyethylene pipe shall be provided from a single manufacturer.

B. High density polyethylene pipe shall have a Standard Dimensional Ratio (SDR) of 21 and minimum pressure rating of 80 psi, and conform to the DIPS sizing system. HDPE Pipe shall be Driscopipe series 4000 HDPE pipe or accepted equal.

PART 3 EXECUTION

3.01 STORAGE AND HANDLING

A. Pipe shall be stored on clean level ground to prevent undue scratching or gouging. Sections of pipe with deep cuts or gouges shall be removed and ends of pipes rejoined. Handling of the joined pipe shall be in such a manner that the pipe is not damaged by dragging over sharp or cutting objects.

B. Lifting of joined pipe sections shall preclude concentration of bending stresses at joints and shall be done in a manner which evenly distributes lifting stresses along the full length of the pipe.

C. Pipe shall be stored in a shaded area or covered to avoid temperature extremes which may cause the pipe to bow or warp.

3.02 INSTALLATION

A. High density polyethylene pipe shall be installed according to the requirements of ASTM D-2321, and the manufacturer's requirements.

B. Care shall be exercised by the CONTRACTOR in placing the pipe to avoid damaging the pipe.

C. Any damage to the HDPE pipes shall be repaired at the CONTRACTOR's expense.

D. Stub ends and pipe fittings for butt fusion shall be fabricated of the same parent material as the HDPE pipe, and shall be of at least the same wall thickness and pressure rating as the pipe to be joined, unless otherwise recommended by the manufacturer.

E. Joining techniques and operating procedures shall follow written instructions provided by the pipe manufacturer and the joint equipment supplier. A copy of such instructions shall be present at any location in which butt fusion is being carried out.

F. Flanged joints shall be used for joining between HDPE and other materials or non-HDPE fittings. Flanged fittings shall have a pressure rating equal to or greater than the pressure rating of the pipe on which they are to be installed. Backup flanges for butt fused joints shall be epoxy-coated ductile iron, drilled to ANSI bolt circles and have a pressure rating of 160 psi. Backup flanges and bolts shall be as approved or supplied by the pipe manufacturer. It is the responsibility of the CONTRACTOR to ensure that the flange bolt circle diameter matches that of other flanged fittings used in the work, and that bolt dimensions are suitable for the fittings to be joined.

G. The pipe shall be installed with uniform bearing under the full length of the pipe.

H. The pipe shall be plugged at the end of each work day or period of work suspension.

3.03 PRELIMINARY CLEANING AND FLUSHING

A. The CONTRACTOR shall flush the pipeline as the work progresses by a means in accordance with good practice to ensure that sand, rocks, or other foreign material are not left in any of the pipeline. If possible the flushing shall be made with an open pipe end. CONTRACTOR shall assume all responsibility for obtaining water and supplies for flushing the force main.

3.04 TESTING OF PIPELINE

A. Source of Water

1. CONTRACTOR shall assume all responsibility to obtain the necessary water supplies for pressure testing of the pipeline.

B. Testing Procedure

1. HDPE Pipe shall be tested hydrostatically at 80 psi for 2 hours in accordance with AWWA standards and DRISCOPIPE Technical note 5.

2. In the case of pipelines that fail to pass the leakage test, CONTRACTOR shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipelines, all at no additional cost to OWNER.

3. The ENGINEER shall be notified at least 48 hours before the pipeline is to be tested so that he may be present during the test.

- END OF SECTION -

SECTION 15070

PRESSURE TESTING EXISTING FORCE MAIN

PART 1 GENERAL

1.01 DESCRIPTION

A. This section covers hydrostatic pressure testing of that portion of the existing 6" diameter PVC sewer force main between the Marina Maintenance Building and Pump Station No. 4, prior to beginning sliplining of the 10" pipe from Pump Station No. 4 towards Saltair.

B. The procedures described herein shall also be used to test all new HDPE sliplining, except that the leakage of the sliplined pipe shall not exceed manufacturer's specifications.

1.02 SUBMITTALS

A. The following shall be submitted:

1. Certified copies of test reports demonstrating conformance to applicable pipe specifications, before pipe is installed.

1.03 MEASUREMENT AND PAYMENT

B. Pressure testing of Existing Force Main shall not be measured or paid for separately, but shall be included in the Lump Sum Cost.

PART 2 PRODUCTS – not used

PART 3 EXECUTION

3.01 TESTING OF PIPELINE

A. General

1. CONTRACTOR shall assume all responsibility to obtain the necessary water and supplies for pressure testing of the pipeline.
2. CONTRACTOR shall furnish all labor, materials, tools, and equipment for testing.
3. Temporary blocking during the tests will be permitted only at temporary plugs, caps or where otherwise directed by the ENGINEER.
4. The ENGINEER shall be notified at least 48 hours before the pipeline is to be tested so that he may be present during the test.

B. Testing Procedure

1. Before applying the specified test pressure, care shall be taken to release all air within the pipe and appurtenances to be tested.
2. A five (5) hour hydrostatic pressure test shall be performed after the pipe and all appurtenances have been installed and after any trench backfill compaction with heavy-duty compaction equipment has been completed. The hydrostatic test pressure shall be 80 psi, or as directed by the ENGINEER.
3. The test pressure shall be applied and continuously maintained by pumping for a period of four (4) hours. During the pumping phase of the test, the test pressure shall be maintained at not less than 95% of the specified test pressure at all times.
4. At the end of the fourth (4^{th}) hour, the pressure shall meet the requirements stated above. Pumping shall then be discontinued for one hour and the drop in pressure shall be recorded at the end of the fifth (5^{th}) hour. Pumping shall then be resumed to restore the initial test pressure, and the quantity of water pumped into the line shall be accurately measured. This measured quantity shall not exceed 0.25 gallons per 1,000 ft. tested.

C. The test results shall be neatly recorded and a paper copy provided to the ENGINEER.

- END OF SECTION -

SECTION 15100

MECHANICAL APPURTENANCES

PART 1 GENERAL

1.01 SUMMARY

A. The CONTRACTOR shall furnish and install all piping and equipment.

1.02 RELATED WORK

A. Related work specified in other sections:

Section 11223 Submersible Pumping Systems
Section 15067 High-Density Polyethylene Pipe

1.03 MEASUREMENT AND PAYMENT

A. Measurement and payment for mechanical appurtenances shall not be paid as a separate item, but shall be included in the Lump Sum Cost.

1.04 SUBMITTALS

A. Submit catalog cuts on all mechanical appurtenances including: fittings, valves, or other items shown on the Drawings referencing each item by mark number. Information shall indicate manufacture specification compliance and dimensional data.

PART 2 PRODUCTS

2.01 AIR RELEASE VALVE

A. Ten (10) Air Release valves shall be Crispin 2-inch orifice, long body, SL Series, pressure sewer air release valves, or accepted equal, and shall be installed, in protective housings on concrete bases, where indicated by the ENGINEER and as shown on the drawings.

2.02 GATE VALVE

A. Gate valves shall be knife gate valves, rated for 150 psi, bi-directional, OS&Y, operated with 2"square AWWA nut on top of a rising stem, suitable for raw wastewater applications, Model No. C67 as manufactured by Fabri-Valve ITT, or accepted equal, for installation in the sizes and at the locations shown on the drawings.

2.03 PIPE SUPPORTS

A. Pipe supports shall be manufactured by Grinnell, and shall be Grinnell Adjustable Pipe Support Model No. 264 (or accepted equal). All pipe supports shall have a 1-inch high grouted pad to be used as a leveling base.

2.04 CHECK VALVE

A. Check valves shall be external arm, metal seated fully opening swing check valves as manufactured by American flow control Model MSCV series 50-SC, for installation at the locations shown on the Drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Valves, valve-operating units, stem extensions and other accessories shall be installed by the CONTRACTOR where shown, or where required in the opinion of the ENGINEER, to provide for convenience in operation. Where buried valves are indicated, the CONTRACTOR shall furnish and install valve boxes to 3-inches above grade in unimproved areas. All gate valves, vaults and boxes shall be new and recently manufactured.

Install mechanical appurtenances as indicated on the plans and in accordance with the manufacturer's written instructions.

Valve boxes shall be installed with concrete collars as noted on the drawings.

- END OF SECTION -

DIVISION 16

ELECTRICAL

SECTION 16050

ELECTRICAL GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 DESCRIPTION

A. It is the intent of this part of the Contract Documents to cover all work and materials necessary for erecting complete, ready for continuous use, a tested and working electrical system, substantially as indicated on the Plans and as hereinafter specified.

1.02 GENERAL PROVISIONS

A. Minimum sizes of equipment, electric devices, etc., are indicated but it is not intended to show every offset and fitting, nor every structural or mechanical difficulty that will be encountered during the installation of the work.

B. All work indicated on the Plans is approximately to scale, but actual dimensions and detailed drawings should be followed as closely as field conditions permit. Field verification of scale dimensions on Plans is directed since actual locations, distances, levels, etc. will be governed by field conditions.

C. Discrepancies indicated on different Plans, between Plans and actual field conditions, or between Plans and Contract Documents shall be promptly brought to the attention of the ENGINEER for a decision.

D. The alignment of equipment and conduit shall be varied due to architectural changes, or to avoid work of other trades, without extra expense to OWNER.

E. CONTRACTOR shall furnish and install all parts and pieces necessary to the installation of equipment in accordance with the best practice of the trade and in conformance with the requirements of these Contract Documents.

F. All items not specifically mentioned in these Contract Documents or noted on the Plans or accepted shop drawings, but which are obviously necessary to make a complete working installation, shall be deemed to be included herein.

G. CONTRACTOR shall layout and install electrical work prior to placing floors and

walls. He shall furnish and install all sleeves and openings through floors and walls required for passage of all conduits. Sleeves shall be rigidly supported and suitably packed or sealed to prevent ingress of wet concrete.

H. CONTRACTOR shall furnish and install all inserts and hangers required to support conduits and other electrical equipment. If the inserts, hangers, sleeves, etc. are improperly placed or installed, CONTRACTOR shall do all necessary work, at his own expense, to rectify the errors.

I. All electrical equipment shall be capable of operating successfully at full-rated load, without failure, at an ambient air temperature of 40 degrees C, and specifically rated for an altitude of 4500 feet.

J. CONTRACTOR shall submit shop drawings, data and details to the ENGINEER on all controls, fixtures, wiring, electrical equipment, conduit, etc. for review and acceptance prior to use of any components in the work.

K. All materials, equipment, and parts comprising any unit or part thereof specified or indicated on the Plans shall be new and unused, of current manufacture, and of highest grade consistent to the state of the art. Damaged materials, equipment and parts are not considered to be new and unused and will not be accepted.

1.03 REGULATIONS AND CODES

A. Electrical work, including connection to electrical equipment integral with mechanical equipment, shall be performed in accordance with the latest published regulations of each of the following as well as all State and local codes.

- NATIONAL ELECTRICAL CODE (NEC)
- NATIONAL ELECTRICAL SAFETY CODE (NESC)
- INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE)
- AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
- AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
- INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)
- NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
- NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)
- FEDERAL OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA)
- UNDERWRITERS' LABORATORIES, INC. (UL)

1.04 COORDINATION OF THE ELECTRICAL SYSTEM

A. CONTRACTOR shall verify all actual equipment and motor full-load and locked-rotor current ratings. The necessary minimum equipment, wire, and conduit sizes are indicated on the Plans. If CONTRACTOR furnishes equipment of different ratings, CONTRACTOR shall coordinate the actual current rating of equipment furnished with the branch circuit conductor size, the overcurrent protection, the controller size, the motor starter, and the branch circuit overcurrent protection. The branch circuit conductors shall have a carrying capacity of not less than 125 percent of the actual full-load current rating. The size of the branch circuit conductors shall be such that the voltage drop from the overcurrent protection devices up to the equipment shall not be greater than 2 percent when the equipment is running at full-load and rated voltage.

B. The motor running overcurrent protection devices shall be rated or selected to trip at no more than 125 percent of the motor full-load current rating for motors marked to have a temperature rise not over 40 degrees C or motors marked with a service factor not less than 1.15 and at no more than 115 percent for all other types of motors. The motor controller size shall be coordinated to the current rating and horsepower size of the installed motor.

C. The motor-branch-circuit overcurrent protection device shall trip open in 30 seconds or less on locked-rotor current of the motor. This device shall also protect the motor-branch-circuit conductors and the motor control apparatus against overcurrent due to short-circuits or grounds. The motor control circuits shall have overcurrent protection of the type indicated on the Plans.

1.05 TEST

A. The electrical work shall be free from improper grounds and from short circuits. The correctness of the wiring shall be verified first by visual comparison of the conductor connections with connection diagrams. Individual circuit continuity checks shall next be made by using electrical circuit testers. Last, the correctness of the wiring shall be verified by the actual electrical operation of the electrical and mechanical devices. Any deviation from the wiring indicated on the Plans or accepted drawings shall be corrected and indicated on the Plans.

1.06 CONFORMS TO RECORD DOCUMENTS DRAWINGS

A. Prior to completion of the Contract, CONTRACTOR shall furnish the ENGINEER with a set of electrical plans marked with any changes, deviations or additions to any part of the electrical work.

B. Each conductor shall be identified as required by the Contract Documents. This identification shall be indicated on the record documents drawings to enable rapid and accurate circuit tracing by maintenance personnel.

1.07 SUBMITTALS

A. Submittals shall be in accordance with Section 01300, CONTRACTOR Submittals.

PART 2 PRODUCTS

2.01 NAMEPLATES

A. Where indicated on the Plans, CONTRACTOR shall furnish and install nameplates which shall be black lamicoid with white letters. The nameplates shall be fastened to the various devices with round head brass screws. Each disconnect means for service, feeder, branch, or equipment conductors shall have nameplates indicating its purpose.

2.02 AUTOMATIC EQUIPMENT WARNING SIGNS

A. Permanent warning signs shall be mounted at all mechanical equipment which may be started automatically or from remote locations. Signs shall be in accordance with OSHA regulations and shall be suitable for exterior use. The warning signs shall be fastened with round head brass screws or bolts, located and mounted in a manner acceptable to the ENGINEER.

B. Warning signs shall be 7 inches high by 10 inches wide, colored yellow and black, on not less than 18 gauge vitreous enameling stock. Sign shall read:

CAUTION
THIS EQUIPMENT STARTS
AUTOMATICALLY
BY REMOTE CONTROL

PART 3 EXECUTION - Not Used

- END OF SECTION -

SECTION 16100

ELECTRICAL EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section includes general electrical equipment used to complete the electrical system.

1.02 RELATED SECTIONS

A. Related work specified in other sections includes but is not limited to:

Section 16050 - Electrical General Requirements
Section 16111 - Conduit
Section 16120 - Conductors
Section 16135 - Electrical Boxes and Fittings

1.03 SUBMITTALS

A. Submittals will be required for all electrical equipment and shall be made in accordance with Section 01300, CONTRACTOR's Submittals.

PART 2 - MATERIALS

2.01 DISCONNECT SWITCHES (INDIVIDUAL)

A. Disconnect switches shall be heavy-duty safety switches with a quick-make, quick-break operating mechanism, full cover interlock and indicator handle. The disconnect switches shall be furnished with fuses of the size indicated on the Plans. One set of spare fuses shall be furnished for each fused disconnect switch.

B. Disconnect switches shall be as manufactured by Square D, Cutler-Hammer, General Electric or approved equal.

2.02 CIRCUIT BREAKERS - LOW VOLTAGE

A. All circuit breaker frame and trip ratings shall be as indicated on the Plans, except

that they shall be coordinated with the ratings of the equipment actually furnished and shall be modified where necessary to suit this equipment. When installed in existing panelboards, match frame size as required. When no indication of type is given on the Plans, the following shall govern:

1. Circuit breakers shall be as manufactured by the existing panel manufacturer.

2.03 FUSES, 0-600 VOLTS

A. Provide a complete set of current-limiting fuses wherever fuses are indicated. Supply a set of six spare fuses of each type and each current rating installed. Utilize fuses that fit mountings specified with switches and which provide features rejecting Class H fuses. Provide the following types:
   1. For 0- to 600-volt motor and transformer circuits, 0- to 600 amps, UL Class RK-1 with time delay, Bussmann Type LPS-RK, Shawmut Type A6D, or equal.
   2. For 0- to 250-volt motor and transformer circuits, 0- to 600 amps, UL Class RK-1 with time delay, Bussmann Type LPN-RK, Shawmut Type A2D-R, or equal.

2.04 INSTRUMENTATION

A. HIGH LEVEL FLOAT
   1. Level sensors shall be suitable for measurement of liquids. The sensor shall be operated on the tip switch, float application, with a NO/NC contacts. The switches shall be rated at 120 VAC.
   2. Mount the float to the wall of the wet well, with enough slack in the cable to allow switch to be completely removed from the wet well (minimum).
   4. The float switch (level sensors) shall be a Flygt, #ENM-10 or equal.

B. WET WELL LEVEL TRANSDUCER

   1. The level measuring system shall consist of an intrinsically safe, 2-wire, loop-powered non-contacting sonic level transducer.
   2. The transducer shall consist of a loop powered electronic module, sonic transducer, housing and terminals. Transducer shall operate over the operational depth of the wet well (refer to civil drawings for dimensions) and shall provide a 4-20 mA dc signal to the control panel.
   3. Transducer shall be constructed from corrosion resistant materials, and listed for installation in Hazardous Class 1, Division 1 environment. Unit

shall be corrosive resistant.

4. Manufacturer / Model:
   a. Siemens-Milltronics, Mini-Ranger
   b. Or approved equal.

C. PUMP SUPERVISION RELAY

1. Relay shall provide motor protection from the following conditions:
   a. Stator windings over-temperature
   b. Seal failure (leakage)
2. Relay shall be compatible with sensors in new lift station motors.
3. Manufacturer / Model:
   a. Flygt MiniCAS
   b. Or approved equal

PART 3 - INSTALLATION

A. Installation shall be as per manufacturers specifications.

B. The CONTRACTOR shall verify that the non-contact sonic type transmitter installation provides a strong echo signal and that the alignment of the level transducer is proper when the calibration of the instrument is performed.

END OF SECTION

SECTION 16111

CONDUIT

PART 1 GENERAL

1.01 DESCRIPTION

A. This section includes flexible or rigid conduits, supports, and nonmetallic ducts.

B. All conduit shall be galvanized rigid steel unless specifically indicated otherwise on the Plans. All wiring, except as otherwise noted, shall be in conduit. Conduit size shall not be less than the National Electrical Code (NEC) size required for the conductors therein and shall not be smaller than 3/4-inch.

C. Conduit runs are schematic only, refer to the Control One-line Diagram, and shall be modified as required to suit field conditions, subject to review and acceptance by the ENGINEER and OWNER.

D. For all spare conduits contractor shall provide pull rope.

1.02 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the test by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C80.1	Rigid Steel Conduit - Zinc-Coated
ANSI C80.3	Electrical Metallic Tubing - Zinc-Coated

FEDERAL SPECIFICATIONS (FS)

FS W-F-406	Fittings for Cable, Power, Electrical and Conduit, Metal Flexible
FS WW-C-566	Conduit, Metal, Flexible

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA TC6	PVC and ABS Plastic Utilities Duct for Underground Installation
NEMA TC9	Fittings for ABS and PVC Plastic Utilities Duct for Underground Installation

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	National Electric Code

UNDERWRITER'S LABORATORIES, INC. (UL)

UL	Underwriter's Laboratories, Inc.

PART 2 PRODUCTS

2.01 METAL CONDUIT AND TUBING

A. Provide metal conduit, tubing and fittings for types, grades, sizes and weights (wall thickness) as indicated; with minimum trade size of 3/4 inch.

B. Rigid Metal Conduit (RMC): ANSI C80.1

C. Rigid and Intermediated Steel Conduit Fittings: Provide fully treaded malleable steel couplings; rain-tight and concrete tight where required by application. Provide double locknuts and metal bushings at conduit termination, use OZ type B bushings on conduits 1-1/4 inch and larger.

D. Flexible Metal Conduit (FMC): FS WW-C-566, Zinc coated steel.

E. Flexible Metal Conduit Fittings: FS W-F-406, Type 1, Class 1 Style A.

F. Liquid Tight Flexible Metal Conduit: Provide liquid-tight, flexible metal conduit; constructed of single strip, flexible continuous, interlocked, and double-wrapped steel; galvanized inside and outside,; coated with liquid-tight jacket of flexible polyvinyl chloride (PVC)

G. Liquid Tight Flexible Metal Conduit Fittings: FS W-F-406, Type 1, Class 3, Style G.

H. Expansion Fittings: OZ Type AX, or equivalent to suit application.

2.02 NONMETALLIC CONDUIT AND DUCTS

A. Where specifically indicated on the drawings, or elsewhere specified, conduit may be high density Schedule 40, 90 degrees C, heavy duty PVC. The conduit shall be manufactured from virgin polyvinyl chloride compound which meets NEMA TC6, Type I for encased burial in concrete Type II for direct burial. Duct fittings shall meet NEMA TC9 and match duct type and materials. Where concrete encasement is required, encasement shall be reinforced as indicated on the drawings. Conduit supports shall be installed at 2-1/2 foot intervals, minimum trade size is 3/4-inch.

2.03 CONDUIT, TUBING, AND DUCT ACCESSORIES

A. Provide conduit, tubing and duct accessories of types and sized, and materials, complying with manufacturer's published product information, which mate and match conduit and tubing. Provide manufactured spacers in all duct bank runs.

B. PVC coated conduit shall be installed where shown on the Plans or elsewhere specified and shall conform to NEMA RN-1, Current Edition.

2.04 LOCKNUTS, BUSHINGS, CONNECTORS, COUPLINGS AND SUPPORTS

A. All cast and malleable iron fittings for use with metallic conduit shall be the threaded type with five full threads..

B. All fittings and boxes shall have neoprene gaskets and non-magnetic stainless steel screws. All covers shall be attached by means of holes tapped into the body of the fitting. Covers for fittings attached by means of clips or clamps will not be acceptable.

C. Boxes wet areas shall be NEMA 4X.

D. Provide insulated-through type ground bushing of the malleable type.

E. In outdoor and indoor areas, conduit shall be terminated in raintight hubs as manufactured by Myers, O.Z. Gedney, or equal.

F. Provide cadmium plated or galvanized fittings.

G. Provide fittings with die-cut threads unless approved otherwise.

H. Malleable Iron Fittings and Boxes

1. All fittings and boxes for use with galvanized steel conduit shall be of malleable iron or gray-iron alloy with zinc plating.

2. Manufacturers, or equal
   a. OZ Gedney
   b. Crouse-Hinds
   c. Appleton

J. PVC Fittings and Boxes

1. All fittings for use with rigid non-metallic conduit shall be PVC, solvent welded type.

2. Boxes shall be PVC or fiberglass reinforced polyester (FRP).

3. Manufacturers or equal
   a. Carlon
   b. Crouse-Hinds
   c. Hoffman.

4. Provide all welding solvent as required for installation of non-metallic conduit and fittings.

K. PVC Coated Fittings

1. All fittings for use with PVC coated RGS shall be PVC coated and shall be products of the same manufacturer as the conduit.

L. Steel Boxes

1. If not indicated otherwise steel boxes shall be NEMA 4, type enclosures.

2. Doors shall have full-length stainless steel piano hinges. Non-hinged boxes are not acceptable.

3. Manufacturers or equal
   a. Hoffman
   b. Rohn
   c. Hammond.

2.05 CONDUIT OUTLET BODIES

A. Rigid Galvanized Steel (RGS) Conduit

1. Rigid steel conduit shall be mild steel, hot-dip galvanized inside and out.

2. Rigid steel conduit shall be manufactured in accordance with ANSI C80.1 – Rigid Steel Conduit, Zinc Coated, and UL-6.

3. Manufacturers or equal
   a. LTV Steel
   b. Triangle
   c. Wheatland Tube.

B. Rigid Non-Metallic Conduit

1. Rigid non-metallic conduit shall be Schedule 40 PVC, sunlight resistant.

2. Rigid PVC conduit shall be manufactured in accordance with NEMA TC-2 – Electrical Plastic Tubing and Conduit, and UL-651 – Standard for Rigid Non-metallic Conduit Standards.

3. Manufacturers, or equal
   a. Carlon
   b. Condux.

C. Rigid PVC Coated Galvanized Steel (RPGS) Conduit

1. The conduit, prior to PVC coating, shall meet the requirements for RGS conduit above.

2. A PVC coating shall be bonded to the outer surface of the galvanized conduit. The bond between the coating and the conduit surface shall be greater than the tensile strength of the coating.

3. PVC coating thickness shall be not less than 40 mils.

4. PVC coated RGS shall be manufactured in accordance with the following standards:
   a. UL-6
   b. ANSI C80.1
   c. NEMA RN1 - PVC Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

5. Manufacturers or equal
   a. Robroy
   b. Ocal.

D. Liquid-tight Flexible Conduit

1. Liquid-tight flexible conduit shall be constructed of a flexible galvanized metal core with a sunlight resistant thermoplastic outer jacket. Maximum length shall be 4 feet.

2. Liquid-tight flexible conduit shall be manufactured in accordance with UL-360 - Steel Conduits, Liquid-Tight Flexible.

3. Manufacturers or equal
   a. Anaconda, "Sealtite"
   b. Electriflex, "Liquatite".

2.06 SCHEDULE OF LOCATIONS

1. All conduit concealed, buried, or encased in concrete shall be Schedule 40 PVC. Where conduit emerges from concrete encasement, a PVC coated RGS elbow shall be utilized for transition from the concrete. Conduit shall emerge from the concrete perpendicular to the surface whenever possible.

2. Exposed conduit shall be 3/4-inch minimum trade size. Encased conduit shall be one-inch minimum trade size. Supports shall be installed at distances required by the NEC.

3. Conduit shall not be encased on the bottom floor slab below grade.

4. Provide flexible conduit for fixture and control wiring with sufficient length of

flexible conduit to avoid transmission of vibration.

5. All threads shall be coated with a conductive lubricant before assembly.

6. Joints shall be tight, thoroughly grounded, secure, and free of obstructions in the pipe. All conduit shall be adequately reamed to prevent damage to the wires and cables inside. Strap wrenches and vises shall be used to install conduit to prevent wrench marks on conduit. Conduit with wrench marks shall be replaced at no additional cost to the OWNER.

7. Conduit passing through walls or floors shall have plastic sleeves. Core drilling shall be performed in accordance with Section 16050 - Electrical General Provisions.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate utility locations in conjunction with all other work.

B. Excavation shall be in accordance with Section 02222.

3.02 INSTALLATION

A. Exposed runs may be installed in the Pump Room.

B. For exposed runs attach surface-mounted conduit with clamps.

C. Unless indicated otherwise, do not install conduit larger than 2-1/2-inches in concrete slabs. Provide a minimum concrete cover over conduit of 4 inches.

D. Install conduit free from dents and bruises. Plug ends to prevent entry of dirt and moisture.

E. Clean out conduit before installation of conductor.

F. Alter conduit routing to avoid structural obstructions, minimizing crossovers.

G. Fill end of conduit with fiberglass where conduits leave heated area and enters unheated area.

H. Provide flashing and pitch pockets, making watertight joints where conduits pass through roof or waterproofing membranes.

I. Route all exposed conduits parallel or perpendicular to building lines.

J. Make interconnections between different types of raceways with manufactured fittings approved by UL.

K. Size raceways in accordance with NFPA 70 tables. Do not reduce from any sized indicated.

L. Do not exceed sizes permitted in slabs or walls.

M. Do not exceed number of bends allowed in conduit by NFPA 70.

N. Make joints wrench tight or otherwise with minimum resistance to the flow of fault currents.

O. Use furred spaces and chases to an advantage in concealing conduits.

P. Make field bends only where needed and then carefully to minimized wire pulling tensions and for best appearance in exposed runs.

Q. Test conduit runs with lignum vitale ball (mandrel) of 85 percent of conduit diameter.

R. Cut conduit with hacksaw or other approved pipe cutting tool and ream ends to clean out all burrs before connecting.

S. Fasten raceways securely in place. Firmly fasten conduit within 18 inches of each outlet, junction box, cabinet, or fitting. Support metallic conduit, rigid nonmetallic conduit in strict accordance with NFPA 70. Use raceway fasteners designed for the purpose.

3.03 PULL BOXES, WIREWAYS, AND GUTTERS

A. Furnish as indicated, plus any such items required to assemble conduits and other raceways. Provide Section 16135 pull boxes as dictated by wire pulling requirements. Unless indicated otherwise face into secondary or unfinished

rooms.

B. Construction: Code gage galvanized sheet steel and sized strictly in conformance with NFPA 70 requirements.

C. Finish: Free of burrs, sharp edges unreamed holes, and sharp-pointed screw or bolts. Paint both inside and out.

D. Coating: When mounted direct to concrete or masonry walls that are below grade or where there will be sweating or other moisture present on wall surface, coat backs of boxes with a heavy, coat backs of boxes with a heavy coat of black asphalt paint before mounting.

E. Protection: Adequate provisions for preventing damage to conductors either during pulling in or from weights and tensions when in place.

F. Weatherproof, rain-tight, or special type when indicated or when required by NFPA 70.

3.04 ANCHORS, FASTENERS, AND MISCELLANEOUS SUPPORTS

A. Anchors used in the Fluoride Room shall be fiberglass or PVC. No metallic conduit supports shall be permitted. Attachment to masonry shall be with 316 stainless steel hardware.

B. Use compatible anchors in roof or ceiling slabs of concrete from which a load is suspended and anchors used to fasten heavy equipment without lead in their construction.

C. Make exposed conduit fastenings with one-piece malleable conduit clamps. Two holes, galvanized sheet metal pipe straps may be used on all concealed installations.

D. Use companion bases or backs with conduit clamps when conduit is exposed to weather or continuous moisture.

E. Use ring type hangers on individual runs of conduit 3 inches and larger if suspended, complete with threaded rods. Use adjustable turnbuckles when specified or otherwise as an option.

F. Support multiple runs of suspended conduits from trapeze style hangers suspended with rigid threaded steel rods and with suitable conduit clamps or straps of the same make as cross channels used.

G. Mount multiple runs of conduit on ceiling or wall surfaces.

H. Do not hang or support electrical equipment and materials from roof decks.

I. Inside wet wells, use stainless steel mounting hardware and fiberglass strut. No steel or PVC coated steel shall be permitted.

- END OF SECTION -

SECTION 16120

CONDUCTORS

PART 1 GENERAL

1.01 DESCRIPTION

A. This section includes installation of wires or cables required for power distribution, service, feeders and branch circuits.

1.02 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70- National Electric Code

UNDERWRITERS' LABORATORIES, INC. (UL)

UL Underwriters' Laboratories, Inc.

1.03 SUBMITTALS

A. Field Test Data: Submit megohmmeter test data for circuits under 600 volts.

PART 2 PRODUCTS

2.01 MATERIALS

A. Building Conductors: Copper, 600 Volt insulation, THWN or XHHW.

B. Branch Circuit Conductors and All Conductors #3 AWG and Smaller: Copper conductor, with THHN, or THWN insulation #10 AWG and smaller, and THHN larger than #10 AWG, where ambient temperature conditions exceed 140 degrees F.

1. Size all conductors in accordance with NFPA 70.

2. Minimum size to be #12 AWG.

3. Stranded conductors for #12 AWG and larger.

4. In damp locations, under slabs, on exterior provide THWN.

C. Cable Supports: OZ cable supports for vertical risers, type as required by application.

2.02 INSTRUMENTATION

A. Instrumentation cable shall have the number of twisted pairs indicated on the Plans and shall be insulated for not less than 600 volts. Unless otherwise indicated, conductor size shall be No. 16 AWG minimum.

B. The jacket shall be flame retardant Flamenal or Okoseal, 90 degrees C temperature rating. The cable shield shall be minimum of 2.3 mil aluminum or copper tape overlapped to provide 100 percent coverage and a tinned copper drain wire.

C. The conductors shall be bare soft annealed copper, Class B, 7 strand minimum concentric lay with Okoseal or Vulkene, 15 mils nominal thickness, nylon jacket, 4 mil nominal thickness, 90 degrees C temperature rating. One conductor within each pair shall be numerically identified.

D. Each cable at each entry to and exit for each instrument, panel, manhole, pullhole, pullbox shall be labeled. .

2.03 COLOR AND CODING OF CONDUCTORS

A. All conductors rated at 120/208 volt shall be color and coded as follows:
1. A-Phase - Black
2. B-Phase - Red
3. C-Phase - Blue
4. Neutral - White
5. Ground - Green

B. All conductors rated at 277/480 volt shall be color and coded as follows:
1. A-Phase - Orange
2. B-Phase - Brown
4. Neutral - White
5. Ground - Green

3. C-Phase - Yellow

PART 3 EXECUTION

3.01 INSTALLATION

A. Lace or clip groups of feeder conductors at distribution center, pull-boxes, and wireway. Neatly arrange wiring within cabinets junction boxes, fixture, etc.

B. Provide copper grounding conductors and straps.

C. Install wire and cable in code conforming raceway.

D. Use nondetrimental wire pulling lubricant for pulling No. 4 AWG and larger wire.

E. Install wire in conduit runs after concrete and masonry work is complete and after moisture is swabbed from conduits.

F. Color code conductors to designate neutral conductor and phase.

G. Furnish necessary reels, reel jacks, and other pulling aids required to prevent damage to wires and cable.

H. Splicing:

1. Install wires and cables continuous without splicers from sources of supply to distribution equipment and from source of supply to motor, lighting, or power outlet.

2. Do not use pull boxes for making splices.

3. Do not install splices in conduits.

I. Install all wiring in accordance with NFPA 70.

J. Use of cable with more conductors then specified; CONTRACTOR's option. When done, tape off and labeled extra conductors as spares.

3.02 CONDUCTOR CONNECTIONS

A. Use approved pressure type solderless connectors and lugs for service entrance

feeder, equipment connections and terminal posts.

B. Use connectors of a type compatible to conductors, locations, and load.

C. Make neutral connection and taps individually in order to prevent the possibility of an "open-neutral".

D. Make branch circuit connections with UL approved solderless connectors. Do not depend solely upon a single insulating material to secure connection as well as to insulate it.

E. After first either silverplating the bars or applying suitable nonoxidizing agents, bolt buss bar connections with adequate nonferrous bolts, washers, and lockwashers.

F. Insulate joints and taps with patented or molded plastic insulators. Use tapes compatible with conductor jackets, temperature, and other conditions.

3.03 IDENTIFICATION OF FEEDERS

A. Affix a marker stamped or embossed of each cable at each entry to and exit for each manhole, pullhole, pullbox, cable tray switchgear and switch, identifying circuit; i.e."PANEL L" "NO 1" etc.

B. Identification letters to be 1/8-inch size minimum.

C. Markers to be rigid, noncorrosive, attached to feeder cables with feeder identification.

D. Nylon straps to be used to tie the markers.

3.04 GROUNDING

A. All equipment cases, devices, etc. shall be grounded.

B. All connections of ground cable to roads or to cable shall be thermoweld connections. Maximum allowable ground resistance shall be 5 ohms.

C. It is the intent of these Contract Documents that a grounding conductor for all device and equipment grounds shall be run as a separate conductor in the conduit

from the equipment to the motor control center or system ground. All wireways, enclosures, etc. shall be properly bonded and grounded, and grounding conductors shall be run for all circuits.

- END OF SECTION -

SECTION 16135

ELECTRICAL BOXES AND FITTINGS

PART 1 GENERAL

1.01 DESCRIPTION

A. This section includes the types of electrical boxes and electrical fitting work.

1.02 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA OS 1	Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
NEMA OS 2	Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	National Electric Code

UNDERWRITERS' LABORATORIES, INC. (UL)

UL	Underwriters' Laboratories, Inc.

1.03 QUALITY ASSURANCE

A. Comply with NFPA 70 as applicable for installation of electrical boxes and fittings.

B. Comply with NEMA OS 1 and NEMA OS 2 as applicable for outlet boxes, device boxes, covers and box supports.

C. Provide electrical boxes and fittings which have been UL-listed and labeled.

PART 2 PRODUCT

2.01 INTERIOR METAL OUTLET BOXES

A. One piece, cast iron or cast aluminum outlet wiring boxes, of types shaped and sizes, including aluminum, essentially "copper free". Do not use on conduits of dissimilar metals, except with written permission.

B. Construct with threaded screw holes with corrosion-resistant screws for securing box and covers and wiring devices.

C. Minimum depth 1-1/4-inches or 2-1/8-inch depth for boxes with 3 or more conduit entries.

D. Use in combination with factory or field bends when indicated or advised. Complete outlet bodies with mounting brackets, hangers, extension rings, fixture studs, cable clamps, metal straps, gaskets, cover, hubs, reducers, and other accessories.

2.02 INTERIOR NON-METALLIC OUTLET BOXES

A. Electrical boxes and fittings in the wet well shall be NEMA 4X non-metallic.

2.03 WEATHERPROOF OUTLET BOX

A. Corrosion-resistant cast-metal of types, shapes and sizes (including depth) required.

B. Threaded conduit ends, cast-metal face plates with spring hinged waterproof caps suitable configured for each application, with face plate gaskets and corrosion-resistant fasteners.

2.04 JUNCTION AND PULL BOXES

A. Building Structure Type: Code-gage sheet steel with screw-on covers; of types, shapes and sizes to suit each respective location and installation; with welded seams and equipped with galvanized steel nuts, bolts, screws and washers.

B. Buried Type: Pre-cast concrete with screw-on cast iron covers; of types, shapes

and sizes to suit each respective location and installation; equipped with stainless steel nuts, bolts, screws and washers.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate installation or electrical boxes and fittings with wire/cable and raceway installation work.

B. Provide knockout closures to cap unused knockout holes where blanks have been removed.

3.02 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS

A. Install where indicated, complying with manufacturer's written instruction applicable requirements of NFPA 70 and NEMA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

B. Install coverplates for all boxes; waterproof outlets for interior and exterior locations exposed to weather or moisture.

C. Install boxes and fittings to ensure ready accessibility of electrical wiring. Install recessed boxes with face of box or ring flush with adjacent surface.

D. Fasten boxes rigidly to substrates or structural surfaces to which attached, or solidly embed boxes in concrete or masonry. Use bar hangers for stud construction. Use of nails for securing boxes is prohibited. Set boxes on opposite sides of common wall with minimum 10 inches of conduit between them.

3.03 SCHEDULE OF LOCATIONS

A. In traffic areas, provide vehicle rated concrete pull boxes mounted flush with the finished surface.

B. In non vehicle traffic areas, plastic pull and junction boxes shall be allowed.

- END OF SECTION -

SECTION 16140

WIRING DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes wall switches; receptacles and device plates.

B. Related Sections
1. Section 16130 - Boxes

1.2 REFERENCES

A. National Electrical Contractors Association
1. NECA - Standard of Installation.

B. National Electrical Manufacturers Association:
1. NEMA WD 1 - General Requirements for Wiring Devices.
2. NEMA WD 6 - Wiring Device -- Dimensional Requirements.

C. National Fire Protection Association:
1. NFPA 70 - National Electrical Code.

1.3 SYSTEM DESCRIPTION

A. Interior and exterior devices located as shown on the drawings.

1.4 SUBMITTALS FOR REVIEW

A. Section 01330 - Submittals: Procedures for submittals.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.5 SUBMITTALS FOR INFORMATION

A. Section 01330 - Submittal Procedures: Submittal procedures.
B. Submit manufacturer's installation instructions.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Provide Products listed and classified by Underwriters Laboratories, Inc., as suitable for the purpose specified and indicated.

1.8 EXTRA MATERIALS

A. Section 01700 - Execution Requirements: Closeout procedures.

PART 2 PRODUCTS

2.1 GFCI RECEPTACLES

A. Manufacturers:
1. Hubbell, GF5262I
2. Pass & Seymor, 2091-I
3. Leviton, 5362-I
4. Leviton, 5362-I
5. Substitutions: Section 01600 - Product Requirements.

B. Description: NEMA WD 1, duplex 2-pole, 3-wire grounded receptacle.

C. Ratings:
1. Voltage: 125 volts, AC.
2. Current: 20 amperes.

D. Device Body: Ivory plastic.

E. Configuration: NEMA WD 6, type as specified and indicated.

2.2 WALL PLATES

A. Weatherproof Cover Plate: Gasketed cast metal with hinged gasketed device cover.

PART 3 EXECUTION

F. EXAMINATION

A. Verify that outlet boxes are installed at proper height.

B. If recessed boxes are approved, verify that wall openings are neatly cut and will be completely covered by wall plates.

C. Verify that floor boxes are adjusted properly.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. If recessed boxes are approved, provide extension rings to bring outlet boxes flush with finished surface.

B. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Install in accordance with NECA "Standard of Installation."

B. Install devices plumb and level.

C. Install receptacles with grounding pole to match existing receptacls.

D. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

E. Install plates on switch, receptacle, and blank outlets in finished areas.

F. Connect wiring devices by wrapping conductor around screw terminal.

G. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

H. Install protective rings on active flush cover service fittings.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 16130 to obtain mounting heights indicated on drawings.

B. Install convenience receptacle 36 inches above finished floor.

3.5 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements. Field inspection, testing, adjusting.

B. Inspect each wiring device for defects.

C. Operate each wall switch with circuit energized and verify proper operation.

D. Verify that each receptacle device is energized.

E. Test each receptacle device for proper polarity.

F. Test each GFCI receptacle device for proper operation.

G. Verify that each telephone jack is properly connected and circuit is operational.

3.6 ADJUSTING

A. Section 01700 - Execution Requirements: Adjusting installed work.

B. Adjust devices and wall plates to be flush and level.

3.7 CLEANING

A. Section 01700 - Contract Closeout: Cleaning installed work.

B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 16903

PROGRAMMABLE LOGIC CONTROLLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Programmable Logic Controller Includes: Small solid state programmable controller using IBM or IBM compatible personal computers.

1.02 RELATED SECTIONS

A. Section 16050 - Electrical General Requirements

B. Section 16100 - Electrical Equipment/Instrumentation

C. Section 16111 - Conduit

D. Section 16120 - Conductors

1.03 SUBMITTALS FOR REVIEW

A. Shop Drawings and Product Data: Include description of components, methods of connecting components, and the following:
   1. Hard copy of the programmable logic controller program with full I/O documentation and explanation of conventions.

B. Operating and Maintenance Manuals. Include the following:
   1. Programming procedures.
   2. System specifications.
   3. Electrical power requirements.
   4. Application considerations.
   5. Explanation of internal fault diagnostics.
   6. Assembly and installation procedures.
   7. Troubleshooting procedures.
   8. Powering up procedures.
   9. Shutdown procedures.
   10. Recommend spare parts list.

1.04 QUALITY ASSURANCE

A. Provide programmable logic controller system components by a single manufacturer, except for programming computers.

B. Use programmable logic controller system manufacturer approved hardware, such as cable, mounting hardware, connectors, enclosures, racks, communication cable, splitters, terminators, and taps.

C. Programmable Logic Controller System Manufacturer Qualifications:

1. Minimum 10 years prior experience.
2. Capable of providing on-site technical service, including start-up and troubleshooting of equipment.
3. Maintains a 24 hours staffed service center.
4. Provides technical and operational training courses to teach Owner in understanding and applying equipment, including training manuals and "hands on" programming experience on a programmable logic controller identical to specified equipment.

D. Programming Installer Qualifications:

1. Qualified by completion of the programmable logic controller manufacturer's training course.
2. Experience of installing at least 5 installations equal to scope of project.

E. Provide a single source responsibility for programmable logic controller system mounting, installation, and wiring.

F. Design and test the programmable logic controller system to operate in an industrial environment per NEMA Standard UCS 2-230 (Arc Test) and IEEE C37.90a CSWC.

G. All programmable logic controller software shall be registered and licensed under the Owner's name.

1.05 ENVIRONMENTAL REQUIREMENTS.

A. Environmental rating for components of the programmable logic controller system, except the programming equipment:

1. Humidity: Maximum 95 percent, non-condensing. Ambient Temperature:

a. Operational: Zero to 60 degrees Celsius.
b. Storage: Minus 40 to 80 degrees Celsius.

B. Electrical Service: 120 VAC, single phase, 50/60 Hertz.

PART 2 PRODUCTS

2.01 MANUFACTURERS:

A. Programmable Logic Controller System:
1. Allen Bradley, MicroLogix 1100 (No equals permitted).

B. Programming Software: Not required.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the programmable logic controller system in accordance with the programmable logic controller manufacturer's instructions and recommendations, including grounding specifications.

3.02 FIELD QUALITY CONTROL

A. Perform conducted susceptibility (RFI, EMI) test as outlined in NEMA ICS 2-230, NEMA ICS 3-304-42, section 2 of IEEE 472-1974 and ANSI C37.90A-1974).

3.03 DEMONSTRATION

A. Establish a mutually agreed upon time for demonstrations with the Owner.

B. Deliver written notification of demonstrations to Owner at least 7 days before demonstrations. Include an agenda for the demonstration and testing procedures with notification.

C. Demonstrate functional operation of programmable logic controller system hardware and logic program at system assembly location prior to shipment.

D. Demonstrate full functional operation of programmable logic controller system

hardware and logic program at the job site when fully integrated to the field I/O's

END OF SECTION